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1991

AIR QUALITY REPORT  
COMMONWEALTH OF MASSACHUSETTS

GOVERNMENT DOCUMENTS  
COLLECTION

OCT 19 1994

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
DIVISION OF AIR QUALITY CONTROL

University of Massachusetts  
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AIR QUALITY SURVEILLANCE BRANCH

37 Shattuck Street

Lawrence, Massachusetts 01843



1991  
AIR QUALITY REPORT

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## SECTION I - AMBIENT AIR CRITERIA POLLUTANT MONITORING

### 1. INTRODUCTION

This report presents 1991 annual air quality information for Massachusetts. Ambient air quality data is collected by the Air Quality Surveillance Branch (AQSB), Division of Air Quality Control (DAQC), Department of Environmental Protection (DEP). The collected data is submitted into the Aerometric Information Retrieval System (AIRS), a computer-based repository of air quality information which is administered by the U.S. Environmental Protection Agency (EPA).

The ambient air quality data is used to verify compliance with state and national ambient air quality standards (see Table 2), to support development of regulations designed to reduce ambient air pollution, to assess the effectiveness of existing air pollution control strategies, to provide aerometric data for special research and to fulfill EPA reporting requirements for ambient air quality data.

The AQSB is responsible (in accordance with the Code of Federal Regulations -40 CFR Part 58) for monitoring ambient air quality for 6 criteria pollutants: sulfur dioxide (SO<sub>2</sub>), ozone (O<sub>3</sub>), carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), lead (Pb) and particulate matter less than or equal to 10 microns (PM<sub>10</sub>). Nitrogen oxide (NO) is monitored in conjunction with NO<sub>2</sub> but it is not a criteria pollutant. In addition, total suspended particulates (TSP), which was the ambient particulate standard prior to July 31, 1987, is monitored. Table 3 provides a summary of the sources of the criteria pollutants and their health effects.

During 1991 the AQSB maintained a public ambient air monitoring network of 37 stations located throughout the Commonwealth. The stations are equipped with various types of monitors which measure for different parameters. Continuous monitors measure for SO<sub>2</sub>, CO, O<sub>3</sub> and NO<sub>2</sub>/NO. At some stations meteorological parameters [including wind speed/wind direction (WS/WD), relative humidity (RH), barometric pressure (BP), temperature (TEMP) and solar radiation] are monitored on a continuous basis as well. The data from the continuous monitors are averaged to provide hourly concentrations. Non-continuous monitors measure PM<sub>10</sub>, Pb, TSP and radiation at an every 6th day frequency taking samples for 24 hours. Table 4 lists the public air monitoring network description as of 12/31/91. Table 5 lists the site directory of the public air monitoring network.

During 1991 the AQSB also oversaw an industrial ambient air monitoring network comprised of 30 air monitoring stations. The industrial network is comprised of continuous monitors for SO<sub>2</sub>, NO<sub>2</sub>/NO, WS/WD and temperature, and, non-continuous monitors for TSP and sulfates (SO<sub>4</sub>). Table 6 lists the industrial air monitoring network description as of 12/31/91. Table 7 lists the site directory of the industrial ambient air monitoring network.

The data from the public and industrial ambient air quality networks has been summarized in this report for public record and information. For further information pertaining to this report contact the Air Quality Surveillance Branch at the address listed on the following page.

For information pertaining to other air quality matters, please contact DEP at the Division of Air Quality Control in Boston or the Regional Offices. The offices are listed in Table 1 on the following page.

**TABLE 1: DEPARTMENT OF ENVIRONMENTAL PROTECTION OFFICES**

**REGION 1 (WESTERN)**

State House West  
436 Dwight St., 4th Floor  
Springfield, MA 01103  
(413) 784-1100

John Higgins: Regional Director

David Howland: Regional Environmental  
Engineer (Bureau of Waste Prevention)

Craig Goff: Section Chief - Air Quality

**REGION 2 (CENTRAL)**

75 Grove St.  
Worcester, MA 01605  
(617) 792-7650

Cornelius J. O'Leary: Regional Director

Michael Maher: Regional Environmental  
Engineer (Bureau of Waste Prevention)

Thomas Cusson: Section Chief - Air Quality

**REGION 3 (NORTHEAST/MET-BOSTON)**

10 Commerce Way  
Woburn, MA 01801  
(617) 935-2164

William Gaughan: Acting Regional Director

Edward Macdonald: Regional  
Environmental Engineer (Bureau of Waste  
Prevention)

James Belsky: Section Chief - Air Quality

**REGION 4 (SOUTHEAST)**

Lakeville State Hospital  
Lakeville, MA 02346  
(508) 946-2700

George Crombie: Regional Director

Chris Tilden: Regional Environmental  
Engineer (Bureau of Waste Prevention)

Vaughan Steeves: Section Chief - Air  
Quality

**DIVISION OF AIR QUALITY CONTROL**

1 Winter St.  
Boston, MA 02108  
(617) 292-5630

Barbara Kwetz: Director

**AIR QUALITY SURVEILLANCE  
BRANCH**

Lawrence Experiment Station  
37 Shattuck St.  
Lawrence, MA 01843  
(508) 975-1138

Donald Steele: Branch Chief



**TABLE 2: STATE AND NATIONAL AMBIENT AIR QUALITY STANDARDS**

POLLUTANT	AVERAGING TIME	PRIMARY STANDARD	SECONDARY STANDARD
SO <sub>2</sub>	Annual Arithmetic Mean	80 µg/m <sup>3</sup> (0.03 ppm)	-----
	24 Hours	365 µg/m <sup>3</sup> (0.14 ppm)	-----
	3 Hours	-----	1300 µg/m <sup>3</sup> (0.50 ppm)
CO	8 Hours	9 ppm (10 µg/m <sup>3</sup> )	Same as the Primary Standard
	1 Hour	35 ppm (40 µg/m <sup>3</sup> )	Same as the Primary Standard
O <sub>3</sub>	* 1 Hour	0.12 ppm (235 µg/m <sup>3</sup> )	Same as the Primary Standard
NO <sub>2</sub>	Annual Arithmetic Mean	0.053 ppm (100 µg/m <sup>3</sup> )	Same as the Primary Standard
PM <sub>10</sub> <sup>1</sup>	Annual Arithmetic Mean	50 µg/m <sup>3</sup>	Same as the Primary Standard
	* 24 Hours	150 µg/m <sup>3</sup>	Same as the Primary Standard
PB	Calender Quarter Arithmetic Mean	1.5 µg/m <sup>3</sup>	Same as the Primary Standard

Standards other than those based upon the annual arithmetic mean are not to be exceeded more than once a year.

**Primary Standard:** The level of air quality necessary, with an adequate margin of safety, to protect the public health.

**Secondary Standard:** The level of air quality necessary to protect the public welfare from the adverse effects of a pollutant.

\* Standard is based upon an estimated exceedance calculation. Estimated exceedances should not exceed 1.0 per year.

µg/m<sup>3</sup> = micrograms per cubic meter; ppm = parts per million

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<sup>1</sup> PM<sub>10</sub> replaced TSP as the ambient particulate standard effective July 31, 1987. It encompasses only those particulates with an aerodynamic diameter less than or equal to 10 microns.



**TABLE 3: POLLUTANTS - THEIR SOURCES AND EFFECTS**

<b>POLLUTANTS AND THEIR SOURCES</b>	<b>HEALTH AND WELFARE EFFECTS</b>
<p><b><u>OZONE (O<sub>3</sub>):</u></b> Product of reactions of motor vehicle exhaust, industrial process emissions and fossil fuel combustion emissions in the presence of sunlight.</p>	<p><b><u>HEALTH:</u></b> Breathing difficulty when exercising; irritates eyes; respiratory infections. Acute exposures cause bronchial constriction, lung edema and abnormal lung development.</p> <p><b><u>WELFARE:</u></b> Toxic to plants causing leaf damage and decrease in growth. Weakens materials such as rubber and fabrics.</p>
<p><b><u>CARBON MONOXIDE (CO):</u></b> Internal combustion engines, fossil fuel combustion and cigarette smoking.</p>	<p><b><u>HEALTH:</u></b> Reduces the blood's ability to carry oxygen which may cause heart and brain damage.</p> <p><b><u>WELFARE:</u></b> No known effect on materials or vegetation.</p>
<p><b><u>SULFUR DIOXIDE (SO<sub>2</sub>):</u></b> Fossil fuel combustion emissions.</p>	<p><b><u>HEALTH:</u></b> Irritation of throat and lungs. Aggravation of symptoms associated with chronic lung disease such as asthma and bronchitis.</p> <p><b><u>WELFARE:</u></b> Causes corrosion of metals, discoloration of paint, deterioration of fabrics and leaf damage to some plants.</p>
<p><b><u>NITROGEN DIOXIDE (NO<sub>2</sub>):</u></b> Emitted from motor vehicles and fossil fuel burning operations.</p>	<p><b><u>HEALTH:</u></b> Aggravation of symptoms associated with asthma and bronchitis. Increased susceptibility to respiratory infections.</p> <p><b><u>WELFARE:</u></b> Fading of dyes, yellowing of leaves, causes reddish brown haze in the atmosphere.</p>
<p><b><u>PARTICULATES (PM<sub>10</sub> + TSP):</u></b> Fossil fuel combustion emissions, industrial process emissions, motor vehicle exhaust and traffic movement over dusty roads.</p>	<p><b><u>HEALTH:</u></b> Aggravation of symptoms associated with chronic lung diseases. Alters lung's natural cleansing mechanism.</p> <p><b><u>WELFARE:</u></b> Causes soiling and corrosion to materials; atmospheric haze.</p>
<p><b><u>SULFATE (SO<sub>4</sub>):</u></b> Is the principal oxidation product of sulfur dioxide released into the atmosphere.</p>	<p><b><u>HEALTH:</u></b> Increases the respiratory toxicity of other air pollutants. Exacerbates respiratory diseases such as asthma and bronchitis.</p> <p><b><u>WELFARE:</u></b> Causes corrosion to materials; atmospheric haze.</p>
<p><b><u>LEAD (Pb):</u></b> Motor vehicle exhaust and smelter emissions.</p>	<p><b><u>HEALTH:</u></b> Mental retardation, brain and other organ damage.</p> <p><b><u>WELFARE:</u></b> No direct impact on vegetation.</p>

**TABLE 4: PUBLIC NETWORK DESCRIPTION (AS OF 12/31/91)**

<b><u>NUMBER OF MONITORING STATIONS</u></b>	<b>37</b>
1 Station (Watertown) was closed during 1991	
<b><u>NUMBER OF CITIES WITH MONITORING STATIONS</u></b>	<b>24</b>
<b><u>CONTINUOUS CRITERIA POLLUTANT (CO,NO2,O3,SO2) MONITORS</u></b>	<b>40</b>
8 ..... CO (Carbon Monoxide)	
6 ..... NO2 (Nitrogen Dioxide)	
15 ..... O3 (Ozone)	
11 ..... SO2 (Sulfur Dioxide)	
<b><u>NONCONTINUOUS CRITERIA POLLUTANT (PM10,Pb) MONITORS</u></b>	<b>27</b>
21 ..... PM10 (Particulate Matter-10 microns). Three stations have collocated <sup>1</sup> monitors. Quabbin has 2 monitors for every third day sampling.	
6 ..... Pb (Lead). Two stations have collocated <sup>1</sup> monitors.	
<b><u>METEOROLOGICAL MONITORS</u></b>	<b>30</b>
1 ..... SOLAR RAD (Solar Radiation)	
1 ..... BP (Barometric Pressure)	
2 ..... RH (Relative Humidity)	
6 ..... TEMP (Temperature)	
10 ..... WD (Wind Direction)	
10 ..... WS (Wind Speed)	
<b><u>OTHER MONITORS</u></b>	<b>29</b>
6 ..... TSP (Total Suspended Particulates). Two stations have collocated <sup>1</sup> monitors.	
17 ..... RAD (Radiation). The first PM10 filter each month is analyzed for radiation.	
4 ..... NPN (National Particulate Network). These are Pb or TSP filters which are sent to EPA for analysis.	
1 ..... IMPROVE <sup>2</sup> . The filter from this monitor is sent to sent to U-Cal (Davis) for analysis.	
1 ..... ACID RAIN. This is a wet/dry deposition sampler.	

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<sup>1</sup> Monitors are collocated (2 monitors at a station which run simultaneously) in order to assess precision.

<sup>2</sup> Interagency Monitoring of Protected Visual Environments



**TABLE 5: PUBLIC SITE DIRECTORY**

CITY SITE LOCATION	AIRS CODE	PARAMETERS MONITORED
<u>ADAMS</u> Mt. Greylock Summit	25-003-4002	O3
<u>AGAWAM</u> 152 Westfield St.	25-013-0003	O3
<u>AMHERST</u> N. Pleasant St.	25-015-0103	O3
<u>BOSTON</u> Kenmore Square 590 Commonwealth Ave.	25-025-0002	SO2;NO2;NO;CO;PB;PM10;TSP; TEMP;RAD
<u>BOSTON</u> Fire Headquarters Southampton St.	25-025-0002	PM10;TSP;NPN;RAD
<u>BOSTON</u> Sumner Tunnel Visconti St. East Boston	25-025-0016	CO
<u>BOSTON</u> 340 Breman St. East Boston	25-025-0024	SO2;NO2;NO;CO;PM10; RAD
<u>BOSTON</u> Fire Station 200 Columbus Ave.	25-025-0024	PM10;RAD
<u>BOSTON</u> 1 City Square Charlestown	25-025-0024	PM10;PB;TSP;NPN RAD
<u>BOSTON</u> Post Office Square	25-025-0038	●9
<u>CHELSEA</u> Soldier's Home Powder Horn Hill	25-025-0024	O3;SO2;NO2;NO;TSP;WS/WD; NPN
<u>CHICOPEE</u> Westover AFB	25-013-0003	O3
<u>EASTON, NORTH</u> Post Office 300 Main St.	25-005-1001	O3;WS/WD

PUBLIC SITE DIRECTORY

CITY SITE LOCATION	AIRS CODE	PARAMETERS MONITORED
<u>FAIRHAVEN</u> Wood School Scontuit Rd.	25-005-1002	O3;WS/WD
<u>FALL RIVER</u> Fire Headquarters 165 Bedford St.	25-005-3001	PM10;RAD
<u>FALL RIVER</u> Fire Station Globe St.	25-005-1004	PM10;RAD
<u>LAWRENCE</u> Storrow Park High St.	25-009-0005	O3;SO2;WS/WD;PM10; RAD
<u>LOWELL</u> Old City Hall Merrimack St.	25-017-0007	CO
<u>MEDFORD</u> Fire Headquarters 100-120 Main St.	25-017-3002	PM10;RAD
<u>NEW BEDFORD</u> YMCA 25 Water St.	25-005-2004	PM10;RAD
<u>NEWBURYPORT</u> National Wildlife Headquarters Plum Island	25-009-4003	O3;WS/WD
<u>QUINCY</u> Fire Station Hancock St.	25-021-0007	PM10;RAD
<u>SCITUATE</u> Police Station First Parish Rd.	25-023-2001	●●
<u>SPRINGFIELD</u> Howard School 59 Howard St.	25-013-0011	PM10;PB;TSP;NPN RAD



**PUBLIC SITE DIRECTORY**

<b>CITY SITE LOCATION</b>	<b>AIRS CODE</b>	<b>PARAMETERS MONITORED</b>
<u>SPRINGFIELD</u> Liberty St.	25-013-0016	SO2;NO2;SO;CO;WS/WD;TEMP;RH
<u>SPRINGFIELD</u> Longhill Ave.	25-013-1009	SO2
<u>SPRINGFIELD</u> 1586 Columbus Ave.	25-013-2007	CO;PM10;PB;TSP RAD
<u>SUDBURY</u> Nat. Wildlife Refuge Water Row Rd.	24-017-1801	O3;PM10;WS/WD;TEMP RAD
<u>TRURO</u> Cape Cod National Park Fox Bottom Area	25-001-0002	O3
<u>WALTHAM</u> U. Mass Field Station Beaver St.	25-017-4003	O3;SO2 Start 5/15; Acid Rain
<u>WARE</u> Quabbin Summit	25-015-4002	O3;SO2;NO2;NO;PM10;WS/WD; TEMP;BP;RH;SOLAR RAD; RAD;IMPROVE
<u>WATERTOWN</u> Victory Field	25-017-1005	SO2. Site terminated 5/15
<u>WEST SPRINGFIELD</u> Fire Station Van Deene St.	25-013-5003	PM10;RAD
<u>WORCESTER</u> U. Mass Medical Center 419 Belmont St.	25-027-0013	PM10;RAD
<u>WORCESTER</u> YWCA 2 Washington St.	25-027-0016	PM10;RAD
<u>WORCESTER</u> State DPW Yard Belmont St.	25-027-0019	O3;SO2;WS/WD;TEMP
<u>WORCESTER</u> Fire Station Central St.	23-027-0020	SO2;NO2;NO;CO



TABLE 6: INDUSTRIAL NETWORK DESCRIPTION (AS OF 12/31/91)

<u>NUMBER OF MONITORING STATIONS</u> .....	30
<u>NUMBER OF CITIES WITH MONITORING STATIONS</u> .....	18
<u>CONTINUOUS CRITERIA POLLUTANT (NO<sub>2</sub>,SO<sub>2</sub>) MONITORS</u> .....	24
4 ..... NO <sub>2</sub> (Nitrogen Dioxide)	
20 ..... SO <sub>2</sub> (Sulfur Dioxide)	
<u>METEOROLOGICAL MONITORS</u> .....	24
2 ..... TEMP (Temperature)	
11 ..... WD (Wind Direction)	
11 ..... WS (Wind Speed)	
<u>OTHER MONITORS</u> .....	20
8 ..... SO <sub>4</sub> (Sulfate)	
12 ..... TSP (Total Suspended Particulates)	

**TABLE 7: INDUSTRIAL SITE DIRECTORY**

<b>REPORTING ORGANIZATION CITY SITE LOCATION</b>	<b>AIRS CODE</b>	<b>PARAMETERS MONITORED</b>
<u>ATLANTIC GELATIN</u> Stoneham Hill Street	25-017-1701	SO2;WS/WD
<u>BOSTON EDISON</u> Boston Atlantic Avenue	25-025-0018	SO2;TSP;SO4
<u>BOSTON EDISON</u> Boston Long Island	25-025-0019	SO2;WS/WD;TSP;SO4
<u>BOSTON EDISON</u> Dorchester Dewar Street	25-025-0020	SO2;WS/WD;TSP;SO4
<u>BOSTON EDISON</u> East Boston Breman Street	25-025-0021	SO2;WS/WD;TSP;SO4
<u>EASTMAN GELATINE</u> Peabody Fox Hill	25-009-1005	SO2;WS/WD
<u>EASTMAN GELATINE</u> Peabody Meadow Pond	25-009-1004	SO2;WS/WD
<u>GENERAL ELECTRIC</u> Lynn Lynnway Street	25-009-2003	SO2;WS/WD;TSP
<u>HAVERHILL PAPERBOARD</u> Haverhill Nettle School	25-009-5004	SO2;WS/WD
<u>MATEP</u> Brookline Fisher Hill Reservoir	25-021-0008	NO;NO2
<u>MATEP</u> Brookline Rte. 9 & Chestnut Hill Ave.	25-021-0009	NO;NO2
<u>MATEP</u> Boston Children's Hospital	25-025-0035	NO;NO2



INDUSTRIAL SITE DIRECTORY

REPORTING ORGANIZATION CITY SITE LOCATION	AIRS CODE	PARAMETERS MONITORED
<u>MATEP</u> Boston Deaconess Hospital	25-025-0036	NO;NO2
<u>MATEP</u> Boston Mission Park Building	25-025-0039	WS/WD
<u>NEW ENGLAND POWER CO.</u> Fall River Globe Street	25-005-0010	SO2
<u>NEW ENGLAND POWER CO.</u> Swansea Sharp's Lot Road	25-005-0010	SO2;WS/WD;TSP;TEMP
<u>NEW ENGLAND POWER CO.</u> Salem Fort Avenue	25-009-2004	WS/WD;TEMP
<u>NEW ENGLAND POWER CO.</u> Marblehead Green Street	25-005-0010	SO2;TSP
<u>NORTHEAST UTILITIES</u> Holyoke Mt. Tom Power Plant	25-013-1010	SO2
<u>NORTHEAST UTILITIES</u> Springfield Longhill Ave.	25-013-1009	SO2
<u>NORTHEAST UTILITIES</u> Springfield Carew Street	25-013-1010	SO2
<u>NORTHEAST UTILITIES</u> West Springfield Power Plant	25-013-5002	SO2
<u>NORTHEAST UTILITIES</u> Hadley Summit House	25-015-1002	SO2
<u>NORTHEAST UTILITIES</u> South Hadley Hopkins Academy	25-015-2001	SO2

INDUSTRIAL SITE DIRECTORY

REPORTING ORGANIZATION CITY SITE LOCATION	AIRS CODE	PARAMETERS MONITORED
<u>NORTHEAST UTILITIES</u> South Hadley Pine Street	25-015-3002	SO2
<u>PIONEER VALLEY TSP GROUP</u> Chicopee Grattan & Meadow St.	25-013-0006	TSP;SO4
<u>PIONEER VALLEY TSP GROUP</u> Springfield Rose & Page Street	25-013-0013	TSP;SO4
<u>PIONEER VALLEY TSP GROUP</u> Springfield Longhill Ave.	25-013-1009	TSP;SO4
<u>PIONEER VALLEY TSP GROUP</u> Northampton Smith College	25-015-0003	TSP;SO4
<u>WELLESLEY COLLEGE</u> Wellesley Observatory Building	25-021-5001	SO2;TSP

## 2. EXCEEDANCES OF AMBIENT AIR QUALITY STANDARDS

The Ambient Air Quality Standards are listed in Table 2 on page 4. Exceedances of the ambient air quality standards during 1991 occurred in the public network for ozone (O<sub>3</sub>) and carbon monoxide (CO). There were no exceedances in the industrial network.

Areas not meeting air quality standards are designated as "nonattainment" areas. The O<sub>3</sub> air quality standard is based on estimated exceedances of the 0.12 ppm standard being greater than 1.0 per year at a site. Massachusetts is nonattainment statewide for ozone.

The CO air quality standards are not to be exceeded more than once a year at a site. If the 2nd maximum value at a site does not exceed the standard then the standard has not been violated. None of the 2nd maximum values for CO exceeded the standards during 1991.

### 2.1 OZONE EXCEEDANCES

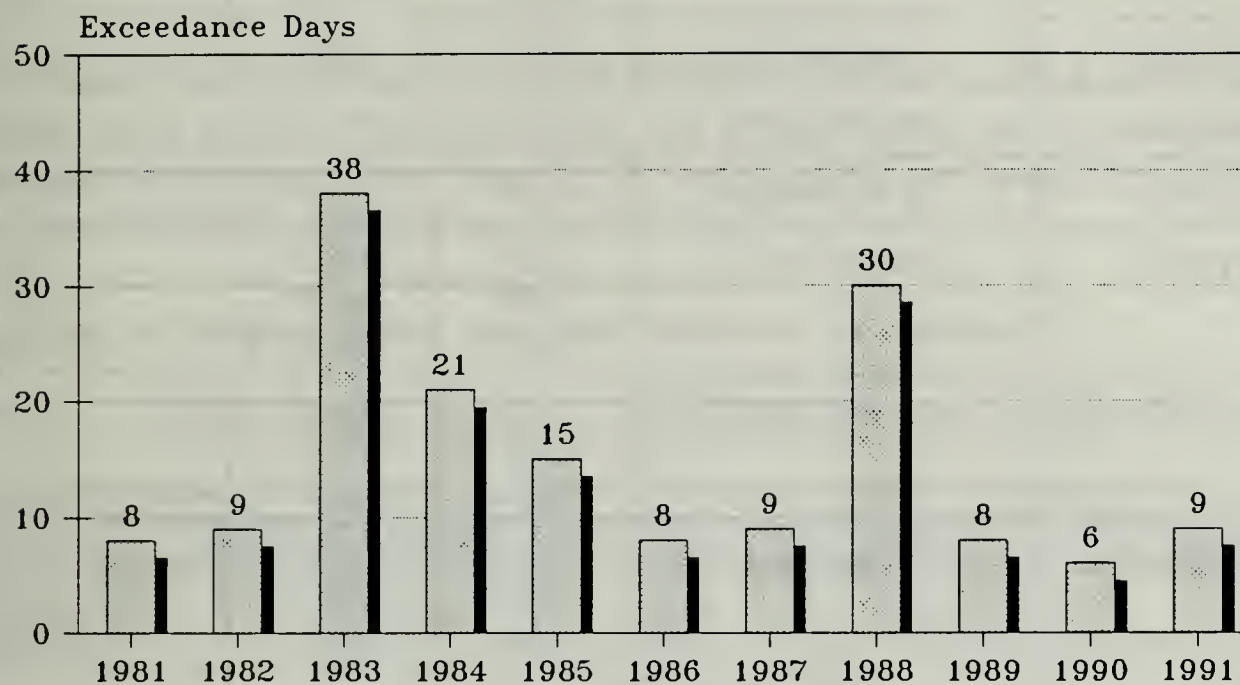
The ozone one hour standard of 0.12 ppm was exceeded at thirteen of the fifteen sites at which ozone was monitored. There were nine exceedance days (days ozone exceedances occurred) during the year. Ten sites exceeded the standard on more than one day. The sites at which exceedances did not occur were located in Lawrence and Adams.

Table 8 lists the ozone exceedance days during 1991.

Table 9 lists the exceedances of the ozone standard during 1991.



# 03 Exceedance Days 1981 to 1991 *Number of days when Ozone exceeded the standard (0.12 ppm)*



The high number of exceedances during 1983 and 1988 coincides with hot summers those years.

figure 1

TABLE 8: 1991 OZONE EXCEEDANCE DAYS

DATE OF EXCEEDANCE	HIGHEST EXCEEDANCE SITE	AIRS CODE	MAXIMUM EXCEEDANCE VALUE (PPM)	NUMBER OF EXCEEDANCE SITES
6/11	TRURO	25-001-0002	0.130	2
6/15	WALTHAM	25-017-4003	0.161	7
6/28	TRURO	25-001-0002	0.154	4
7/17	TRURO	25-001-0002	0.130	2
7/18	TRURO	25-001-0002	0.165	3
7/19	EASTON	25-005-1001	0.156	9
7/23	TRURO	25-001-0002	0.130	9
8/01	WORCESTER	25-027-0019	0.161	5
8/17	WARE	25-015-4002	0.133	3

**TABLE 9: 1991 OZONE EXCEEDANCES**

CITY	AIRS CODE	DATE	HOUR	O3 VALUE (PPM)
AGAWAM	25-013-0003	7/19	2300	0.141
		8/17	1500	0.130
AMHERST	25-015-0103	8/17	1500	0.127
CHELSEA	25-025-1003	7/19	1500	0.126
CHICOPEE	25-013-0008	7/19	1700	0.133
EASTON	25-005-1001	6/15	1700	0.145
		7/17	1900	0.127
		7/19	1200	0.156
FAIRHAVEN	25-005-1002	6/11	1400	0.128
		6/28	1600	0.132
		7/18	1600	0.150
NEWBURYPORT	25-009-4003	7/18	1500	0.133
		7/19	1600	0.140
		8/01	2000	0.128
SCITUATE	25-023-2001	6/15	1700	0.128
		7/19	1300	0.126
SUDBURY	25-017-1801	6/15	1900	0.127
		8/01	1900	0.126
TRURO	25-001-0002	6/11	1600	0.130
		6/15	1400	0.128
		6/28	1700	0.154
		7/17	1700	0.139
		7/18	1800	0.165
		7/19	1200	0.130
		7/23	1800	0.130
WALTHAM	25-017-4003	6/15	1800	0.161
		6/28	1300	0.130
		8/01	1800	0.128
WARE	25-015-4002	6/15	2000	0.149
		6/28	1700	0.128
		7/19	1700	0.151
		8/01	1900	0.149
		8/17	1500	0.133
WORCESTER	25-027-0019	6/15	1800	0.139
		7/19	1600	0.125
		8/01	1800	0.151



## 2.2 CARBON MONOXIDE EXCEEDANCES

The carbon monoxide 8 hour standard of 9 ppm was exceeded at the Worcester (Central St.) site. It was the only exceedance that occurred out of the eight carbon monoxide monitoring sites. The last exceedance of the 8 hour standard occurred in 1987.

The CO air quality standards are not to be exceeded more than once a year at a site. If the 2nd maximum value at a site does not exceed the standard then the standard has not been violated. None of the 2nd maximum values for CO exceeded the standards during 1991. The last violation of the CO 8 hour standard occurred in 1986.

Table 10 lists information about the carbon monoxide exceedance.

**TABLE 10: 1991 CARBON MONOXIDE EXCEEDANCES**

CITY	AIRS CODE	DATE	HOUR	CO VALUE (PPM)
WORCESTER	25-027-0020	1/15	16 TO 23	11.5

### CO 8-Hr Exceedances 1981 to 1991 *# of Exceedance Days and Violation Sites* *8-Hr Standard = 9 ppm*

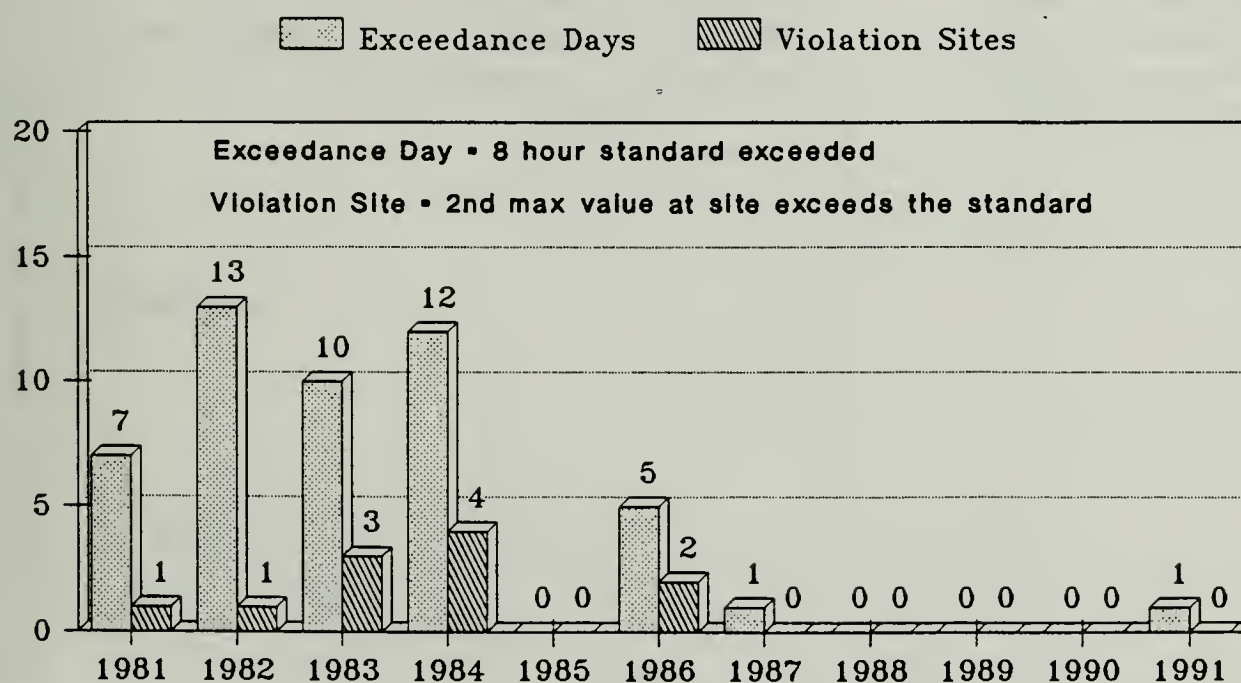


figure 2



### 3. AMBIENT AIR QUALITY DATA - PUBLIC NETWORK

#### 3.1 POLLUTANT STANDARD INDEX (PSI)

The Pollutant Standard Index (PSI) provides a simple, uniform way to report concentrations of ozone (O<sub>3</sub>), which is the primary component of smog. A PSI value of 100 is equivalent to the national ambient air quality standard for O<sub>3</sub> (0.12 ppm).

The Division of Air Quality Control (DAQC) predicts the day's O<sub>3</sub> PSI value during ozone season (April through October) using the weather forecast and evaluating the previous day's O<sub>3</sub> and oxides of nitrogen (NO, NO<sub>2</sub>) levels from the statewide monitoring network. The DAQC reports O<sub>3</sub> PSI values daily during ozone season for the Eastern, Central and Western regions of Massachusetts.

Table 11 lists the health effects associated with the different PSI categories and values.

Table 12 lists the number of days during the 1991 ozone season that fell into the good, moderate or unhealthful categories for each region.

**TABLE 11: POLLUTANT STANDARD INDEX (PSI) AND GENERAL HEALTH EFFECTS**

INDEX VALUE	PSI DESCRIPTOR	GENERAL HEALTH EFFECTS	CAUTIONARY STATEMENTS
500	Very Hazardous	Premature death of ill and elderly. Healthy persons will experience adverse symptoms <sup>1</sup> that affect their normal activities.	All persons should remain indoors, keeping windows and doors closed. All persons should minimize physical exertion and avoid traffic areas.
400	Hazardous	Premature onset of heart and lung diseases. Significant aggravation of symptoms <sup>1</sup> and decreased exercise tolerance in healthy persons.	Elderly and persons with existing respiratory diseases should stay indoors and avoid physical exertion. General population should avoid physical activity.
300	Very Unhealthful	Significant aggravation of symptoms <sup>1</sup> and decreased exercise tolerance in persons with heart or lung disease. Widespread symptoms <sup>1</sup> in the healthy population.	Elderly and persons with existing heart or lung diseases should stay indoors and avoid physical activity.
200	Unhealthful	Mild aggravation of symptoms <sup>1</sup> in susceptible persons. Irritation symptoms <sup>1</sup> in the healthy population.	Persons with existing heart or respiratory ailments should reduce physical exertion and outdoor activity.
100	Moderate		
50			
0	Good		

<sup>1</sup> Symptoms include eye and throat irritation and respiratory problems such as breathing difficulty and congestion.

**TABLE 12: 1991 PSI BY REGION DURING OZONE SEASON**

MONTH	REGION	GOOD PSI	MODERATE PSI	UNHEALTHFUL PSI
APRIL	Eastern	19	11	3
	Central	27	3	0
	Western	19	11	2
MAY	Eastern	15	13	0
	Central	18	10	0
	Western	13	19	0
JUNE	Eastern	15	12	3
	Central	20	9	1
	Western	15	13	2
JULY	Eastern	9	18	4
	Central	20	10	1
	Western	11	19	1
AUGUST	Eastern	11	18	2
	Central	20	10	1
	Western	17	12	2
SEPTEMBER	Eastern	22	8	4
	Central	27	3	0
	Western	23	7	0
OCTOBER	Eastern	30	1	0
	Central	29	2	0
	Western	27	4	0
TOTAL (OZONE SEASON)	Eastern	121	84	9
	Central	161	50	3
	Western	125	84	5

DEFINITION OF PSI CATEGORIES	
GOOD	PSI OF 0 TO 50
MODERATE	PSI OF 50 TO 100
UNHEALTHFUL	PSI OF 100 TO 200

REGION	COUNTY
EASTERN	Essex, Middlesex, Suffolk, Norfolk, Bristol, Plymouth, Barnstable
CENTRAL	Worcester
WESTERN	Berkshire, Franklin, Hampshire, Hampden



# Number of Days in PSI Categories

*By region during Ozone season  
(April through October)*

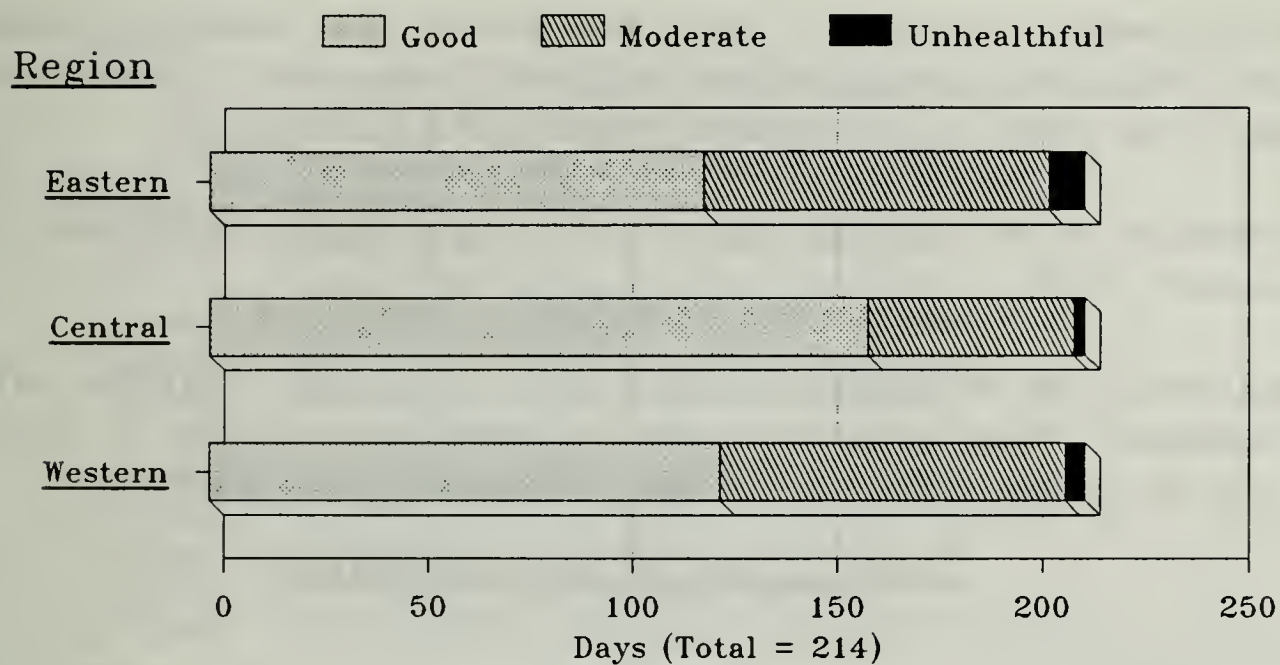


figure 3

## DEFINITION OF PSI CATEGORIES

GOOD	PSI OF 0 TO 50
MODERATE	PSI OF 50 TO 100
UNHEALTHFUL	PSI OF 100 TO 200

### 3.2 OZONE (O3) DATA SUMMARY

There were fifteen O3 sites during 1991 in the state operated network. All of the sites achieved 75% or greater data capture except Agawam (66%). The O3 data capture for all sites combined is shown in Section 3.10, figure 25 (pg 44).

The O3 air quality standard (0.12 ppm 1-hour average) was exceeded at thirteen of the fifteen sites. The highest 1-hour value was 0.165 ppm at Truro which is 138% of the standard. See Section 2.1 (pg 14) for more information regarding O3 exceedances.

O3 is measured by an automated analyzer which takes samples continuously to provide hourly averaged values.

Table 13 lists by site the O3 data during the ozone season (April 1 to October 31) including the four maximum 1-hour values, the number of values that exceeded the O3 air quality standard and the number of days that O3 data was reported (100% is 214).

**TABLE 13: 1991 O3 DATA SUMMARY**

OZONE (44201)				MASSACHUSETTS				UNITS: 007 PPM							
				OZONE SEASON: APR 01 TO OCT 31											
SITE ID	P O M C T CITY	COUNTY	ADDRESS	YR	ORG	REP * *MEAS	NUM REQ	VALID DAILY 1-HR MAXIMUM				VALS>0.12 MEAS	* MISS DA * ASSUMED	STANDARD	
								-----MAXIMA-----	1ST	2ND	3RD	4TH			
25-001-0002	1 3	TRURO	BARNSTABLE	FOX BOTTOM AREA	91	001	197	214	.165	.154	.139	.130	7	7.6	0
25-003-4002	1 2	ADAMS	BERKSHIRE C	MT. GREYLOCK	91	001	186	214	.111	.103	.103	.097	0	0.0	2
25-005-1001	1 1	EASTON	BRISTOL CO	N. EASTON POS.OF.	91	001	201	214	.156	.145	.127	.121	3	3.1	5
25-005-1002	1 2	FAIRHAVEN	BRISTOL CO	L. WOOD SCHOOL	91	001	206	214	.150	.132	.128	.118	3	3.1	1
25-009-0005	1 1	LAWRENCE	ESSEX CO	HIGH ST; STORROW	91	001	210	214	.122	.119	.104	.102	0	0.0	2
25-009-4003	1 1	NEWBURYPORT	ESSEX CO	PARKER RIVER NWR	91	001	201	214	.140	.133	.128	.123	3	3.1	4
25-013-0003	1 2	AGAWAM	HAMPDEN CO	152 S. WESTFIELD	91	001	143	214	.141	.130	.123	.118	2	3.0	0
25-013-0008	1 1	CHICOPEE	HAMPDEN CO	WESTOVER AFB	91	001	213	214	.133	.115	.106	.101	1	1.0	1
25-015-0103	1 3	AMHERST	HAMPSHIRE C	N. PLEASANT ST.	91	001	213	214	.127	.111	.105	.099	1	1.0	1
25-015-4002	1 1	WARE	HAMPSHIRE C	QUABBIN SUMMIT	91	001	184	214	.151	.149	.149	.133	5	5.7	4
25-017-1801	1 1	SUDBURY	MIDDLESEX C	WATER ROW RD	91	001	205	214	.127	.126	.116	.113	2	2.1	3
25-017-4003	1 3	WALTHAM	MIDDLESEX C	BEAVER STREET	91	001	212	214	.161	.130	.128	.124	3	3.0	2
25-023-2001	1 3	SCITUATE	PLYMOUTH CO	SCITUATE POLICE	91	001	202	214	.128	.126	.117	.115	2	2.1	3
25-025-1003	1 1	CHELSEA	SUFFOLK CO	POWDER HORN HILL	91	001	211	214	.126	.122	.108	.107	1	1.0	3
25-027-0019	1 1	WORCESTER	WORCESTER C	DPW-BELMONT ST	91	001	214	214	.151	.139	.125	.112	3	3.0	0

METHODS:		OZONE (44201)			ANALYSIS METHOD
		CODE	COLLECTION METHOD		
		=====	=====		=====
		000	MULTIPLE METHODS		MULTIPLE METHODS
		047	INSTRUMENTAL		ULTRA VIOLET
		053	INSTRUMENTAL		ULTRA VIOLET

#### ABBREVIATIONS AND SYMBOLS USED IN TABLE 13

SITE ID = AIRS SITE IDENTIFICATION NUMBER POC = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE)  
MT = MONITOR TYPE (1 = NAMS, 2 = SLAMS, 3 = OTHER) YR = YEAR REP ORG = REPORTING ORGANIZATION NUM MEAS = NUMBER OF DAYS MEAS  
NUM REQ = NUMBER OF DAYS IN OZONE SEASON 1ST,2ND,3RD,4TH MAXIMA = MAXIMUM 1HR VALUE FOR THE 1ST,2ND,3RD,4TH HIGHEST DAY  
VALS > 0.12 MEAS = NUMBER OF MEASURED DAILY MAXIMUM VALUES GREATER THAN OR EQUAL TO 0.12 PPM  
VALS > 0.12 EST = NUMBER OF EXPECTED VIOLATIONS OF THE OZONE STANDARD  
MISS DAYS ASSUMED < STANDARD = NUMBER OF MISSING DAYS ASSUMED TO BE LESS THAN THE OZONE STANDARD METH = METHOD CODE FOR ANALYSIS



## 03 1st Max 1 Hour Values

*Standard = 0.125 ppm*

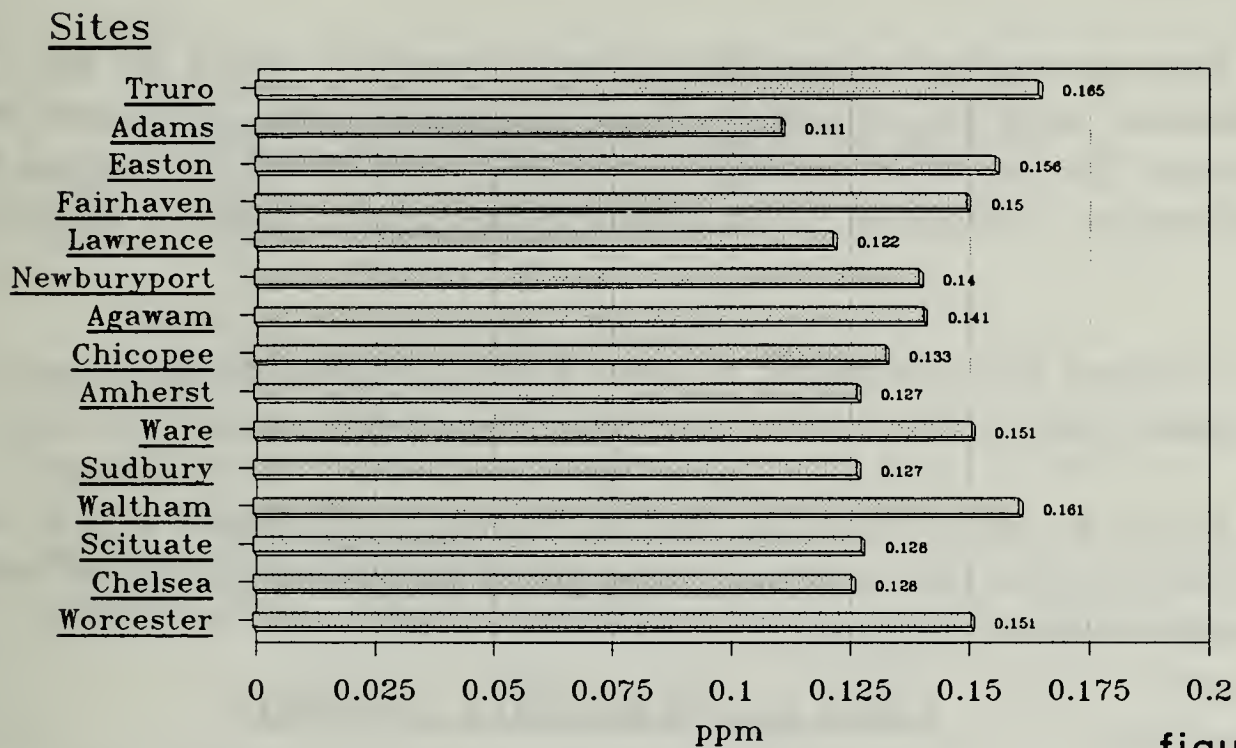


figure 4

## 03 2nd Max 1 Hour Values

*Standard = 0.125 ppm*

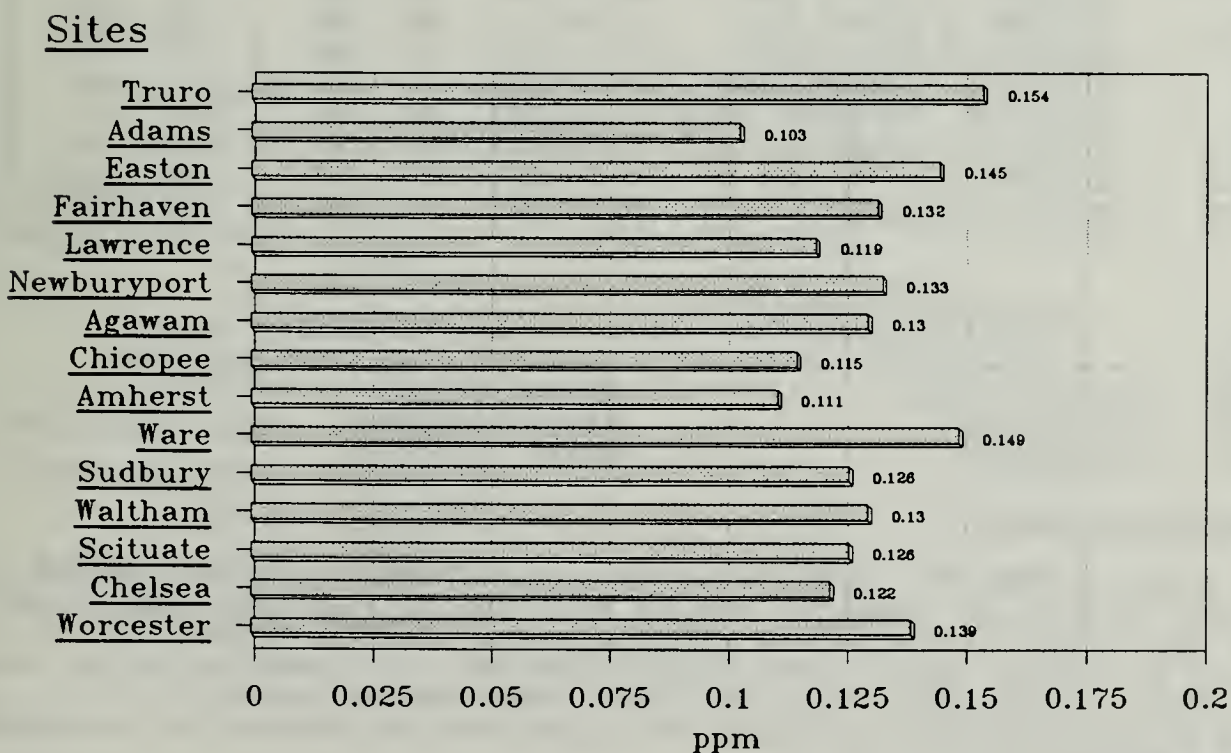


figure 5



### 3.3 SULFUR DIOXIDE (SO<sub>2</sub>) DATA SUMMARY

There were twelve SO<sub>2</sub> sites during 1991 in the state operated network. The site in Watertown was replaced with a site located in Waltham in May. All of the sites achieved 75% or greater data capture. The SO<sub>2</sub> data capture for all sites combined is shown in section 3.10, figure 26 (pg 45).

There were no violations of the SO<sub>2</sub> air quality standards during the year. The highest annual arithmetic mean was 0.011 ppm at Boston (Kenmore Square) and Chelsea which is 37% of the standard. The highest 24-hour value was 0.042 ppm at Springfield (Liberty St.) which is 30% of the standard. The highest 3-hour value was 0.183 ppm at Lawrence which is 37% of the standard.

SO<sub>2</sub> is measured by an automated analyzer which takes samples continuously to provide hourly averaged values.

**Table 14** lists by site the SO<sub>2</sub> data for 1991 including the number of hour observations (100% is 8760) the 1st and 2nd maximum values for 24 hour, 3 hour and 1 hour periods, as well as the annual arithmetic mean.

**TABLE 14: 1991 SO<sub>2</sub> DATA SUMMARY**

SULFUR DIOXIDE (42401)					MASSACHUSETTS			UNITS: 007 PPM							
SITE ID	P O M C T CITY	COUNTY	ADDRESS	REP YR ORG #OBS	MAX 24-HR		OBS	MAX 3-HR		OBS	MAX 1-HR		ARIT MEAN		
					1ST	2ND	> 0.14	1ST	2ND	> 0.50	1ST	2ND			
25-005-1004	1 1	FALL RIVER	BRISTOL CO	GLOBE STREET	91 001 8673	.034	.034	0	.083	.078	0	.134	.133	.009	
25-009-0005	1 1	LAWRENCE	ESSEX CO	HIGH ST; STORROW	91 001 8634	.038	.032	0	.152	.068	0	.183	.168	.008	
25-013-0016	1 1	SPRINGFIELD	HAMPDEN CO	LIBERTY STREET	91 001 8679	.042	.039	0	.079	.069	0	.102	.092	.010	
25-013-1009	1 1	SPRINGFIELD	HAMPDEN CO	LONGHILL STREET	91 001 8469	.033	.032	0	.062	.056	0	.095	.081	.010	
25-015-4002	1 2	WARE	HAMPSHIRE CO	QUABBIN SUMMIT	91 001 8162	.023	.022	0	.044	.041	0	.056	.050	.005	
25-017-1005	1 1	WATERTOWN	MIDDLESEX CO	VICTORY FIELD	91 001 3144	.033	.033	0	.085	.058	0	.104	.085	.010	
25-017-4003	1 1	WALTHAM	MIDDLESEX CO	BEAVER STREET	91 001 5487	.021	.020	0	.039	.038	0	.065	.062	.005	
25-025-0002	1 1	BOSTON	SUFFOLK CO	KENMORE SQUARE	91 001 8533	.039	.032	0	.061	.060	0	.080	.079	.011	
25-025-0021	1 1	BOSTON	SUFFOLK CO	340 BREMAN STREET	91 001 8695	.032	.029	0	.055	.054	0	.084	.077	.009	
25-025-1003	1 1	CHELSEA	SUFFOLK CO	POWDER HORN HILL	91 001 8675	.037	.036	0	.073	.063	0	.090	.083	.011	
25-027-0019	1 2	WORCESTER	WORCESTER CO	DPW-BELMONT ST	91 001 8654	.025	.023	0	.040	.040	0	.047	.046	.005	
25-027-0020	1 1	WORCESTER	WORCESTER CO	CENTRAL STREET	91 001 8439	.040	.029	0	.058	.058	0	.088	.079	.009	

METHODS:	SULFUR DIOXIDE (42401)		ANALYSIS METHOD
	CODE	COLLECTION METHOD	
	====	=====	=====
	000	MULTIPLE METHODS	MULTIPLE METHODS
	009	INSTRUMENTAL	PULSED FLUORESCENT
	060	INSTRUMENTAL	PULSED FLUORESCENT

#### ABBREVIATIONS AND SYMBOLS USED IN TABLE 14

SITE ID = AIRS SITE IDENTIFICATION NUMBER POC = PARAMETER OCCURENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE)  
MT = MONITOR TYPE (1 = NAMS, 2 = SLAMS, 3 = OTHER) YR = YEAR REP ORG = REPORTING ORGANIZATION #OBS = NUMBER OF HOUR OBSERVATIONS  
MAX 24-HR, MAX 3-HR, MAX 1-HR 1ST 2ND = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED  
OBS > .14 = NUMBER OF 24-HR AVG. GREATER THAN 0.140 PPM (24-HR STANDARD) OBS > .50 = NUMBER OF 3-HR AVG. GREATER THAN 0.500 PPM  
STANDARD) ARIT MEAN = ARITHMETIC MEAN (STANDARD = 0.030 PPM) METH = METHOD CODE FOR ANALYZER  
? = INDICATES THAT NUMBER OF OBSERVATIONS WERE INSUFFICIENT TO CALCULATE MEAN. THE WATERTOWN SITE WAS CLOSED ON MAY 15 AND REPLACED  
WITH THE WALTHAM SITE WHICH BEGAN MONITORING ON MAY 15.

## S02 Maximum 1 Hour Values

*Standard = None*

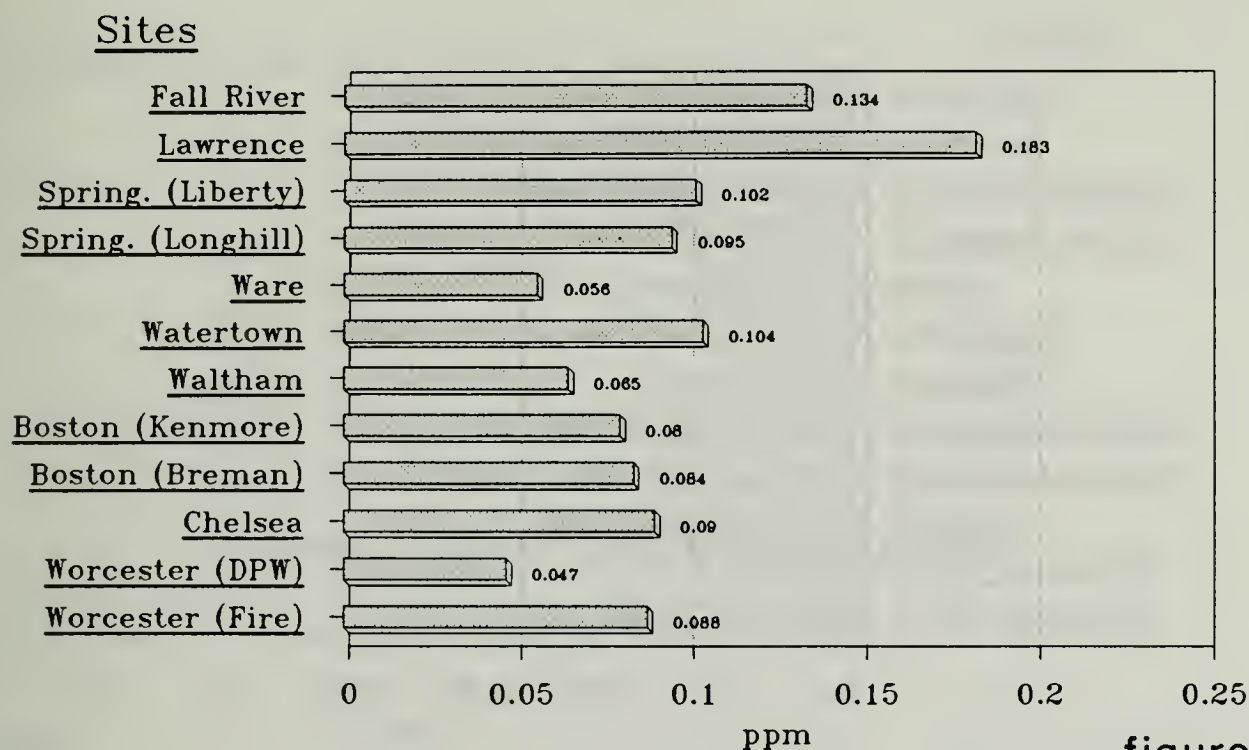


figure 6

## S02 Maximum 3 Hour Values

*Standard = 0.5 ppm*

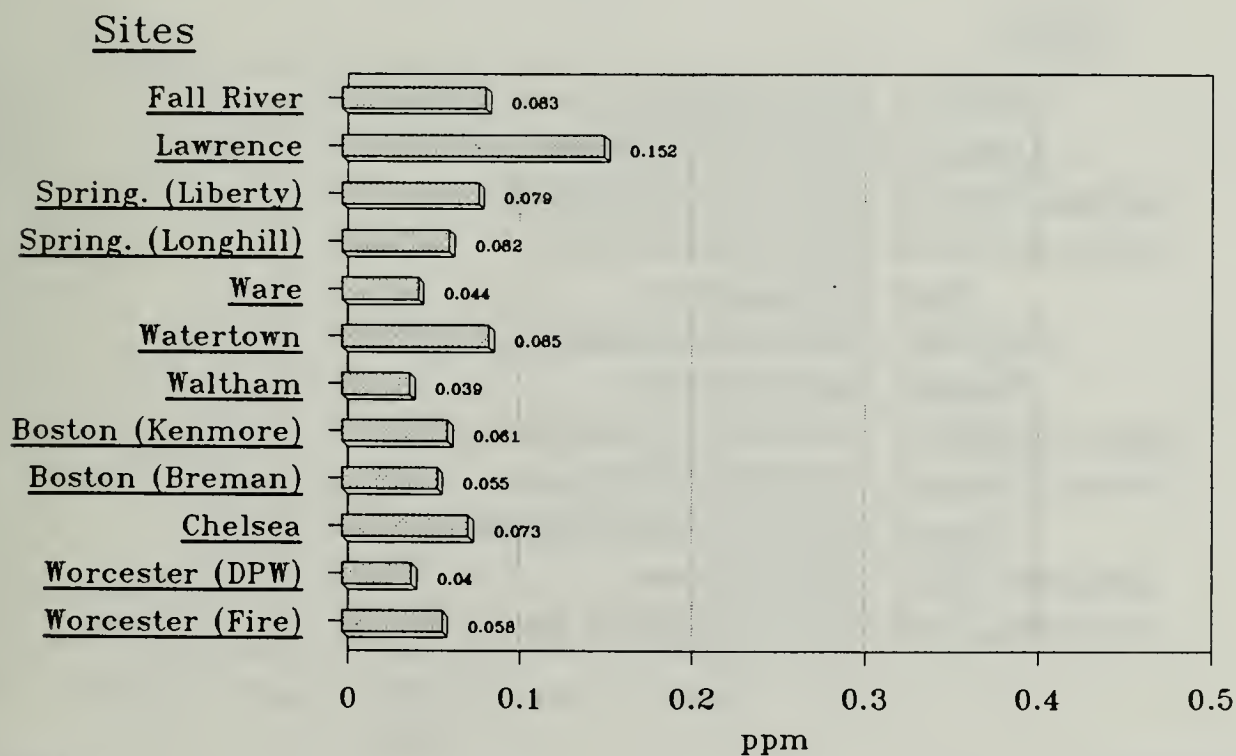


figure 7

## S02 Maximum 24 Hour Values

*Standard = 0.14 ppm*

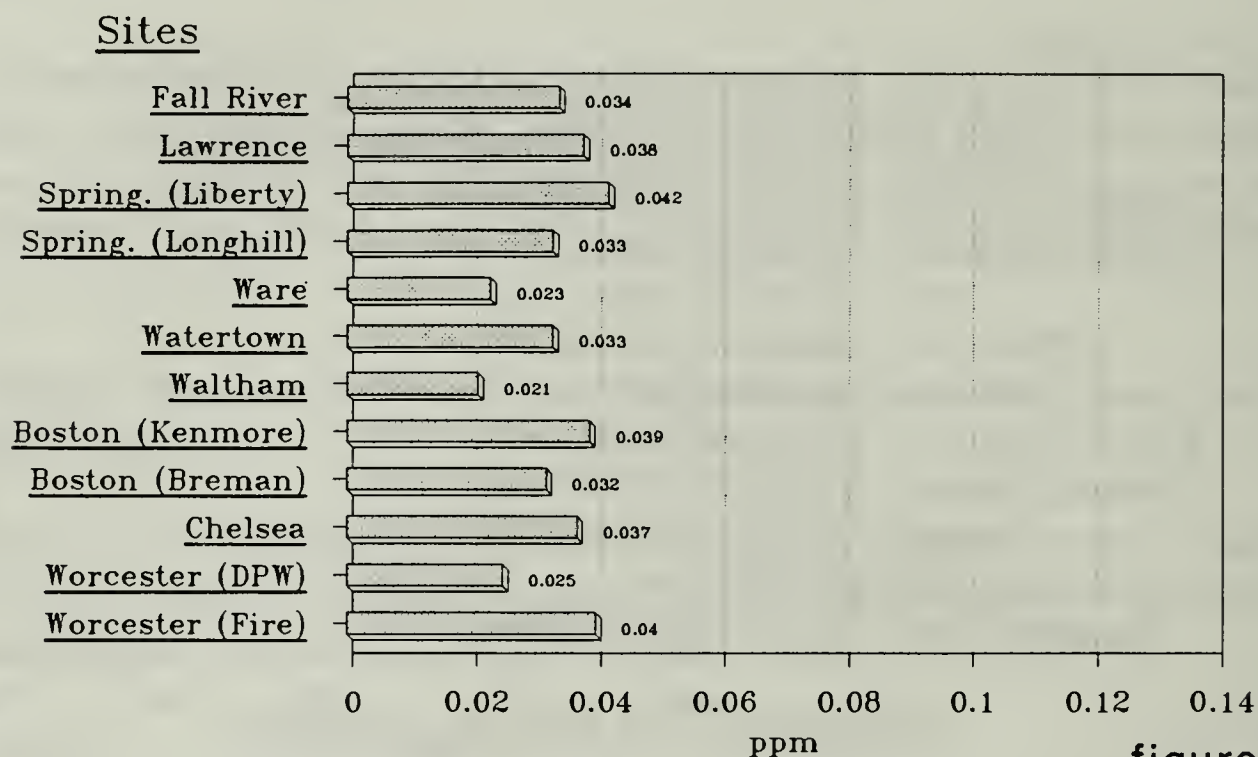


figure 8

## S02 Annual Arithmetic Means

*Standard = 0.03 ppm*

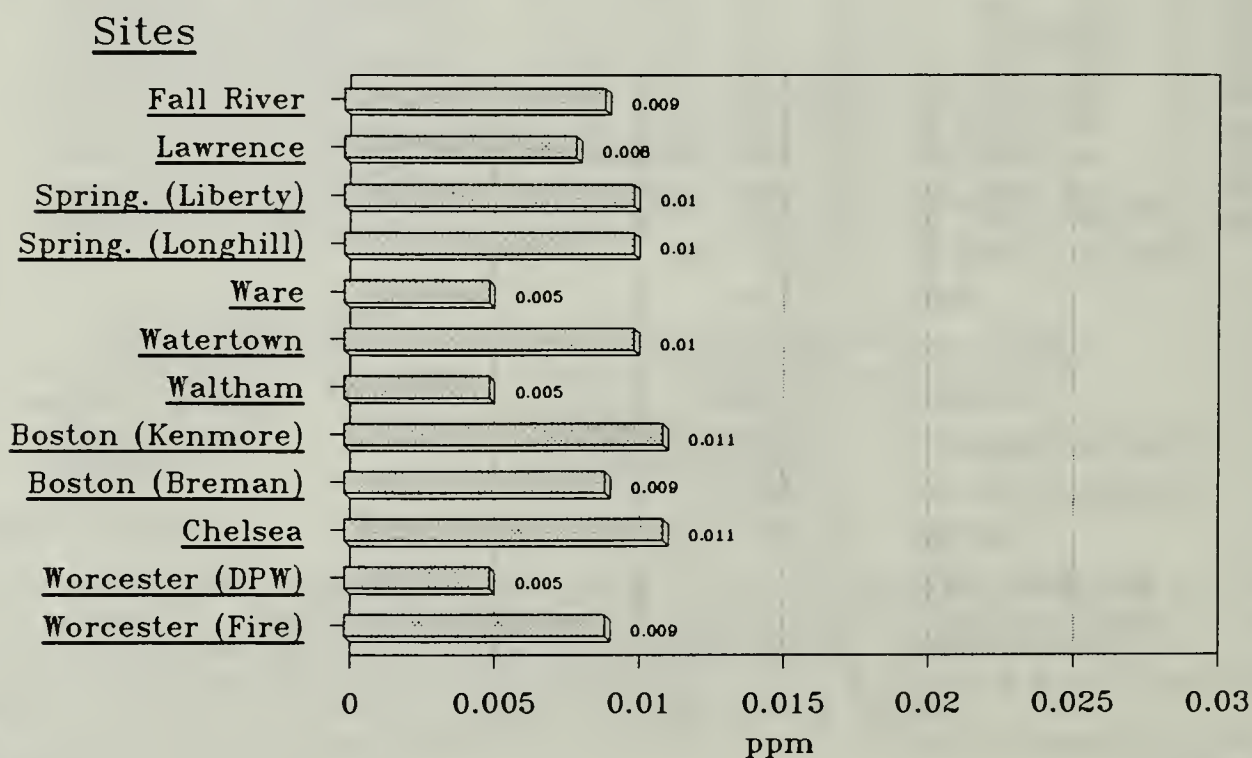


figure 9



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### 3.4 NITROGEN DIOXIDE (NO2) DATA SUMMARY

There were six NO2 sites during 1991 in the state operated network. All of the sites achieved 75% or greater data capture. The NO2 data capture for all sites combined is shown in Section 3.10, figure 27 (pg 45).

There were no violations of the NO2 air quality standard during the year. The highest annual arithmetic mean was 0.035 ppm at Boston (Kenmore Sq.) which is 70% of the standard.

NO2 is measured by an automated analyzer which takes samples continuously to provide hourly averaged values.

Table 15 lists by site the NO2 data for 1991 including the number of hour observations (100% is 8760), the 1st and 2nd maximum 1-hour values and the annual arithmetic mean.

TABLE 15: 1991 NO2 DATA SUMMARY

NITROGEN DIOXIDE (42602)				MASSACHUSETTS			UNITS: 007 PPM					
SITE ID	P	O M	CITY	COUNTY	ADDRESS	REP YR ORG	#OBS	MAX 1ST	1-HR 2ND	MAX 1ST	24-HR 2ND	ARIT MEAN
	C	T										
25-013-0016	1	2	SPRINGFIELD	HAMPDEN CO	LIBERTY STREET	91	001	8565	.162	.146		.026
25-015-4002	1	3	WARE	HAMPSHIRE CO	QUABBIN SUMMIT	91	001	7601	.081	.079		.009
25-025-0002	1	3	BOSTON	SUFFOLK CO	KENMORE SQUARE	91	001	8211	.154	.150		.035
25-025-0021	1	1	BOSTON	SUFFOLK CO	340 BREMAN STREET	91	001	8511	.092	.089		.032
25-025-1003	1	1	CHELSEA	SUFFOLK CO	POWDER HORN HILL	91	001	8393	.091	.087		.027
25-027-0020	1	2	WORCESTER	WORCESTER CO	CENTRAL STREET	91	001	8645	.071	.067		.023

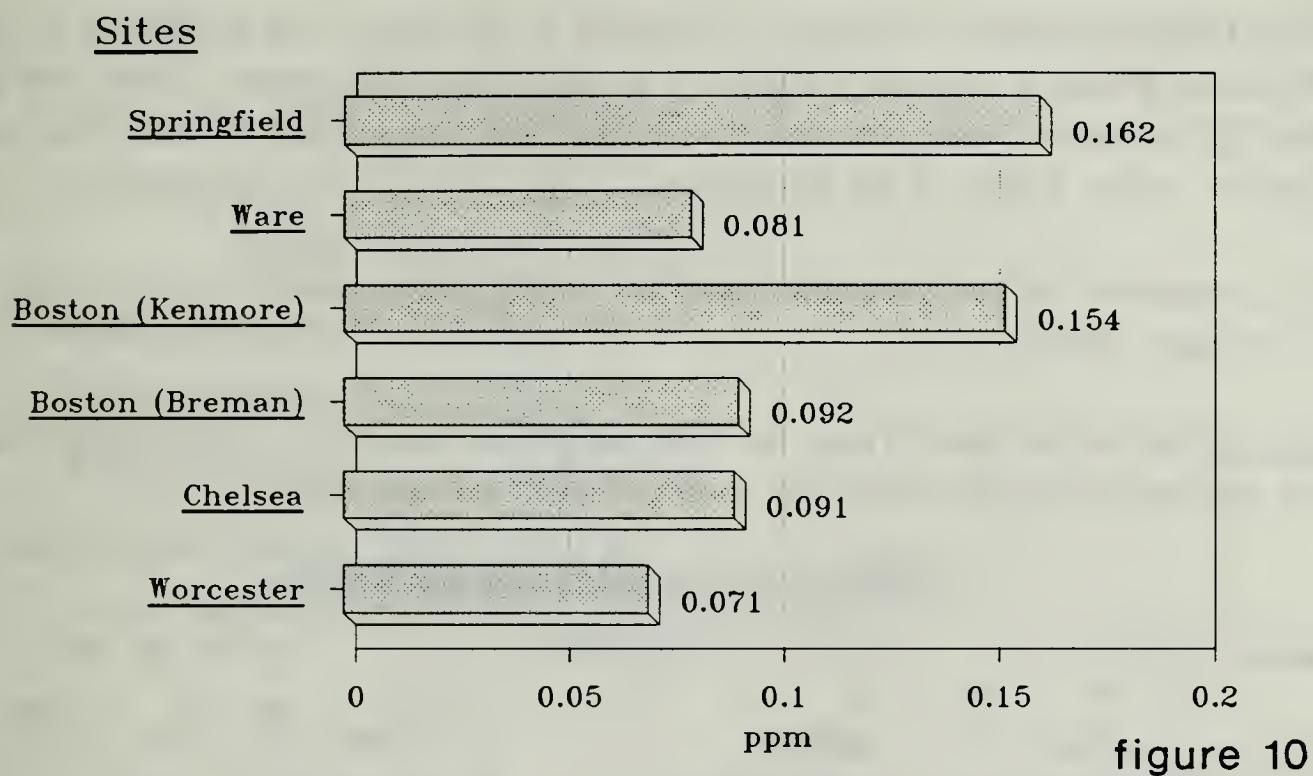
METHODS:	NITROGEN DIOXIDE (42602)		ANALYSIS METHOD
	CODE	COLLECTION METHOD	
	====	=====	=====
	035	INSTRUMENTAL	CHEMILUMINESCENCE
	042	INSTRUMENTAL	CHEMILUMINESCENCE

#### ABBREVIATIONS AND SYMBOLS USED IN TABLE 15

SITE ID = AIRS SITE IDENTIFICATION NUMBER POC = PARAMETER OCCURENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE)  
MT = MONITOR TYPE (1 = NAMS, 2 = SLAMS, 3 = OTHER) YR = YEAR REP ORG = REPORTING ORGANIZATION #OBS = NUMBER OF HOUR OBSERVATION  
MAX 1-HR 1ST 2ND = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED  
ARIT MEAN = ARITHMETIC MEAN (STANDARD = 0.053 PPM) METH = METHOD CODE FOR ANALYZER

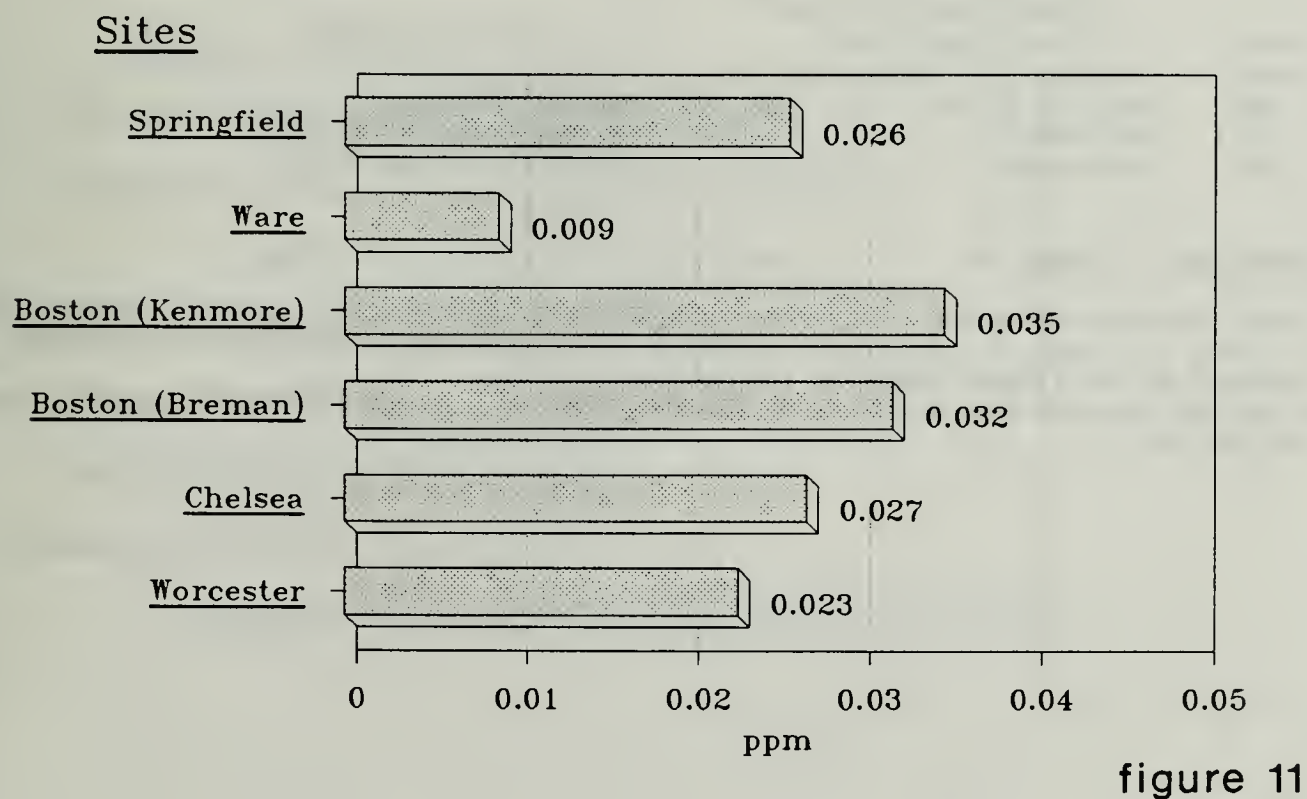
## N02 Maximum 1 Hour Values

*Standard = None*



## N02 Annual Arithmetic Means

*Standard = 0.053 ppm*





### 3.5 CARBON MONOXIDE (CO) DATA SUMMARY

There were eight CO sites during 1991 in the state operated network. All of the sites achieved 75% or greater data capture. The CO data capture for all sites combined is shown in Section 3.10, figure 28 (pg 46).

The CO 8-hour standard (9 ppm) was exceeded at Worcester with a value of 11.7 ppm which is 130% of the standard. Section 2.2 (pg 17) contains more information about the exceedance. No other CO standards were exceeded during the year. The highest 1-hour value was 15.8 ppm at Worcester which is 45% of the standard.

CO is measured by an automated analyzer which takes samples continuously to provide hourly averaged values.

Table 16 lists by site the CO data for 1991 including the number of hour observations (100% is 8760), and the maximum values for 1-hour and 8-hour periods.

**TABLE 16: 1991 CO DATA SUMMARY**

CARBON MONOXIDE (42101)					MASSACHUSETTS			UNITS: 007 PPM						
SITE ID	P	O M	C T CITY	COUNTY	ADDRESS	YR	REP ORG	#OBS	MAX 1-HR		OBS> 35	MAX 8-HR		OBS 9
									1ST	2ND		1ST	2ND	
25-013-0016	1	1	SPRINGFIELD	HAMPDEN CO	LIBERTY STREET	91	001	8705	11.0	9.8	0	7.4	6.5	0
25-013-2007	1	1	SPRINGFIELD	HAMPDEN CO	EAST COLUMBUS AVENUE	91	001	8575	10.7	10.6	0	8.1	6.1	0
25-017-0007	1	2	LOWELL	MIDDLESEX CO	MERRIMACK STREET	91	001	8346	12.5	11.1	0	6.4	5.8	0
25-025-0002	1	2	BOSTON	SUFFOLK CO	KENMORE SQUARE	91	001	8659	7.4	6.5	0	4.9	4.2	0
25-025-0016	1	2	BOSTON	SUFFOLK CO	SUMNER; VISCONTI ST.	91	001	8353	7.9	7.2	0	5.3	4.2	0
25-025-0021	1	1	BOSTON	SUFFOLK CO	340 BREMAN STREET	91	001	8431	7.9	6.5	0	3.7	3.6	0
25-025-0038	1	1	BOSTON	SUFFOLK CO	POST OFFICE SQUARE	91	001	8639	8.0	6.7	0	4.3	4.2	0
25-027-0020	1	2	WORCESTER	WORCESTER CO	CENTRAL STREET	91	001	8704	19.6	15.8	0	11.7	7.2	1

METHODS:	CARBON MONOXIDE (42101)		
	CODE	COLLECTION METHOD	ANALYSIS METHOD
	====	=====	=====
	000	MULTIPLE METHODS	MULTIPLE METHODS
	041	INSTRUMENTAL	NON DISPERSIVE INFRA-RED
	051	INSTRUMENTAL	NON DISPERSIVE INFRA-RED

#### ABBREVIATIONS AND SYMBOLS USED IN TABLE 16

SITE ID = AIRS SITE IDENTIFICATION NUMBER POC = PARAMETER OCCURENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE)  
MT = MONITOR TYPE (1 = NAMS, 2 = SLAMS, 3 = OTHER) YR = YEAR REP ORG = REPORTING ORGANIZATION #OBS = NUMBER OF HOUR OBSERVATION  
MAX 1-HR 1ST 2ND = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED  
OBS > 35 = NUMBER OF 1-HR AVG. GREATER THAN 35 PPM (1-HR STANDARD) OBS > 9 = NUMBER OF 8-HR AVG. GREATER THAN 9 PPM (8-HR STANDARD)  
METH = METHOD CODE FOR ANALYZER

## CO Maximum 1 Hour Values

*Standard = 35 ppm*

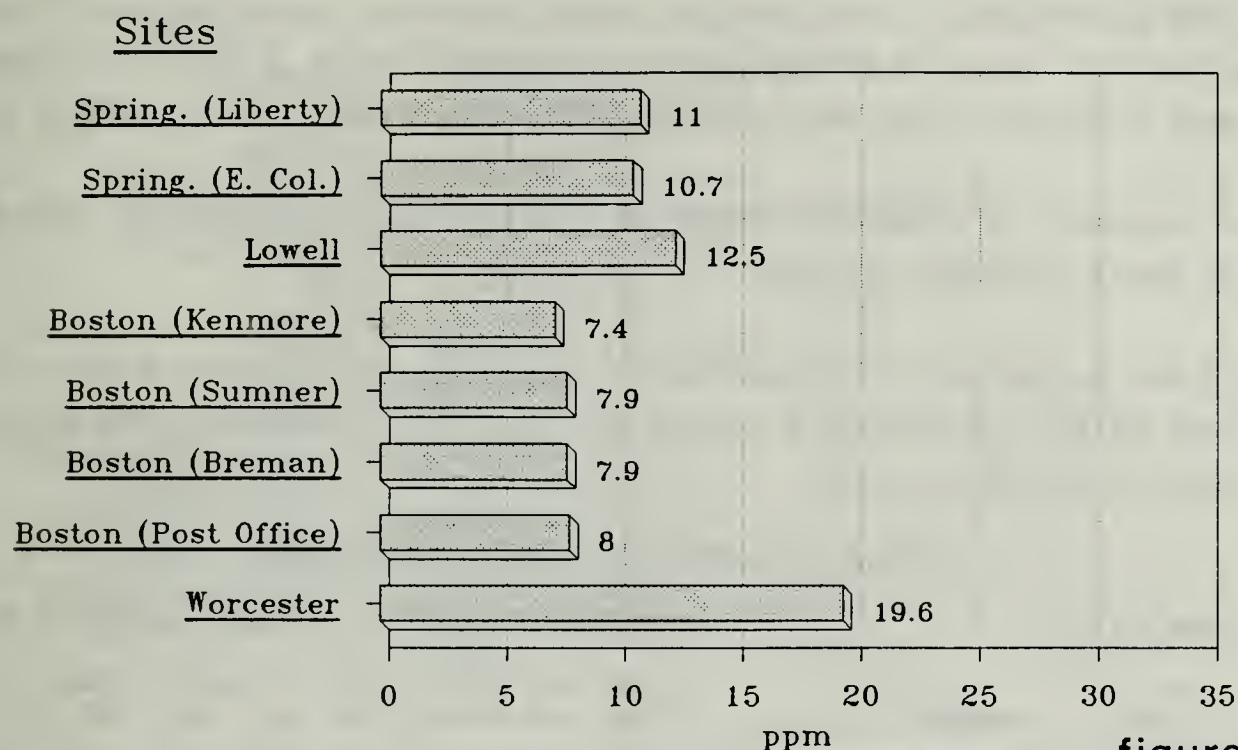


figure 12

## CO Maximum 8 Hour Values

*Standard = 9 ppm*

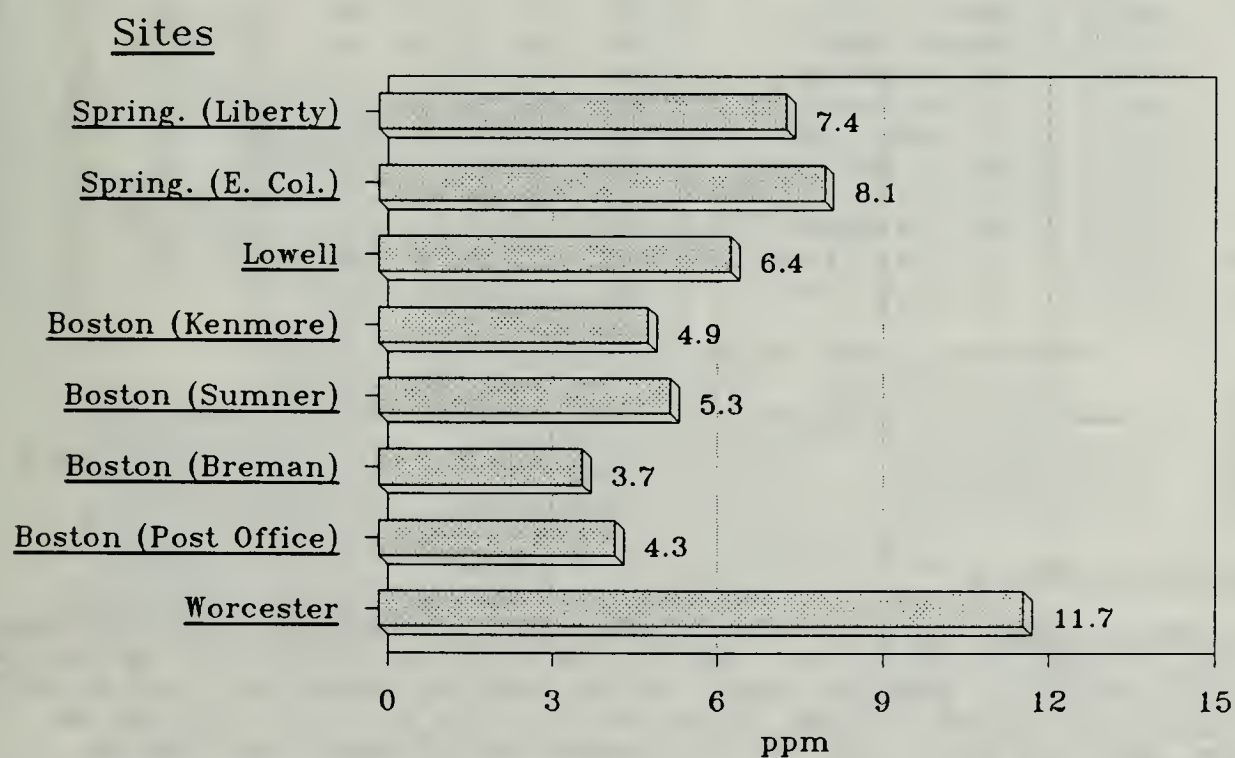


figure 13



### 3.6 PARTICULATE MATTER 10-MICRONS (PM10) DATA SUMMARY

There were seventeen PM10 sites during 1991 in the state operated network. Three sites had collocated samplers (samplers which operate simultaneously for precision assessment). All of the sites achieved 75% or greater data capture except for Ware (66% - unable to replace motor parts) and Worcester YWCA (27% - roof repairs). The PM10 data capture for all sites combined is shown in Section 3.10, figure 29 (pg 46).

There were no violations of the PM10 air quality standards during the year. The highest 24-hour value was 105 ug/m3 at Springfield (E. Columbus) which is 70% of the standard. The highest annual arithmetic mean was 33 ug/m3 at Boston (City Sq.) which is 66% of the standard.

PM10 is measured by a manual sampler in which samples are collected during a 24 hour period on an every sixth day schedule.

Table 17 lists by site the PM10 data for 1991 including the number of observations (100% is 60; for Ware 100% is 120 because it samples at an increased frequency), the maximum values and the weighted arithmetic mean.

**TABLE 17: 1991 PM10 DATA SUMMARY**

PM-10 TOTAL 0-10UM (81102)					MASSACHUSETTS					UNITS: 001 UG/CU METER (25 C)								
SITE ID	P O M C T CITY	COUNTY	ADDRESS	YR	REP ORG	SCHEDULED				NUM REQ	MAXIMUM VALUES-----				VALS > 150 EST	WT ARI ME		
						NUM OBS	NUM OBS	% OBS	1ST		2ND	3RD	4TH	MEAS				
25-005-2004	1 3	NEW BEDFOR	BRISTOL CO	YMCA, 25 WATER STREET	91	001	56	56	93	60	65	51	43	42	0	0.00		
25-005-3001	1 2	FALL RIVER	BRISTOL CO	165 BEDFORD STREET	91	001	51	51	85	60	68	50	45	41	0	0.00		
25-009-0005	1 3	LAWRENCE	ESSEX CO	HIGH ST; STORROW PARK	91	001	57	57	95	60	45	35	32	31	0	0.00		
25-013-0011	2 2	SPRINGFIEL	HAMPDEN CO	59 HOWARD STREET	91	001	53	53	88	60	57	53	49	45	0	0.00		
25-013-2007	1 1	SPRINGFIEL	HAMPDEN CO	EAST COLUMBUS AVENUE	91	001	58	58	97	60	105	66	65	59	0	0.00		
25-013-2007	3 3	SPRINGFIEL	HAMPDEN CO	EAST COLUMBUS AVENUE	91	001	50	50	83	60	78	67	60	55	0	0.00		
25-013-5003	1 2	WEST SPRIN	HAMPDEN CO	VAN DEENE STREET	91	001	54	54	90	60	61	48	48	44	0	0.00		
25-015-4002	1 2	WARE	HAMPSHIRE	QUABBIN SUMMIT	91	001	85	79	66	120	45	31	31	31	0	0.00		
25-017-1801	1 2	SUDBURY	MIDDLESEX	WATER ROW RD	91	001	57	57	95	60	46	45	43	42	0	0.00		
25-017-3002	1 2	MEDFORD	MIDDLESEX	100 TO 120 MAIN ST	91	001	57	57	95	60	64	49	46	37	0	0.00		
25-021-0007	1 3	QUINCY	NORFOLK CO	HANCOCK STREET	91	001	55	55	92	60	46	45	35	33	0	0.00		
25-025-0002	1 1	BOSTON	SUFFOLK CO	KENMORE SQUARE	91	001	59	59	98	60	51	51	47	46	0	0.00		
25-025-0012	1 1	BOSTON	SUFFOLK CO	115 SOUTHAMPTON ST	91	001	57	57	95	60	57	51	44	37	0	0.00		
25-025-0012	2 3	BOSTON	SUFFOLK CO	115 SOUTHAMPTON ST	91	001	55	55	92	60	56	51	43	37	0	0.00		
25-025-0021	1 2	BOSTON	SUFFOLK CO	340 BREMAN STREET	91	001	57	57	95	60	53	53	43	39	0	0.00		
25-025-0024	1 1	BOSTON	SUFFOLK CO	200 COLUMBUS AVENUE	91	001	58	57	95	60	52	46	45	40	0	0.00		
25-025-0027	1 1	BOSTON	SUFFOLK CO	ONE CITY SQUARE	91	001	60	60	100	60	68	65	64	59	0	0.00		
25-025-0027	3 3	BOSTON	SUFFOLK CO	ONE CITY SQUARE	91	001	55	55	92	60	71	60	60	58	0	0.00		
25-027-0013	1 2	WORCESTER	WORCESTER	419 BELMONT STREET	91	001	58	58	97	60	47	47	47	41	0	0.00		
25-027-0016	1 1	WORCESTER	WORCESTER	YWCA-WASHINGTON ST	91	001	17	16	27	60	43	32	25	23	0	0.00		

METHODS:		PM-10 TOTAL 0-10UM (81102)		ANALYSIS METHOD	
		CODE	COLLECTION METHOD		
		=====	=====		
		062	HI-VOL-WEDDING-INLET	GRAVIMETRIC	
		063	HI-VOL-SA/GMW-1200	GRAVIMETRIC	
		064	HI-VOL-SA/GMW-321-B	GRAVIMETRIC	

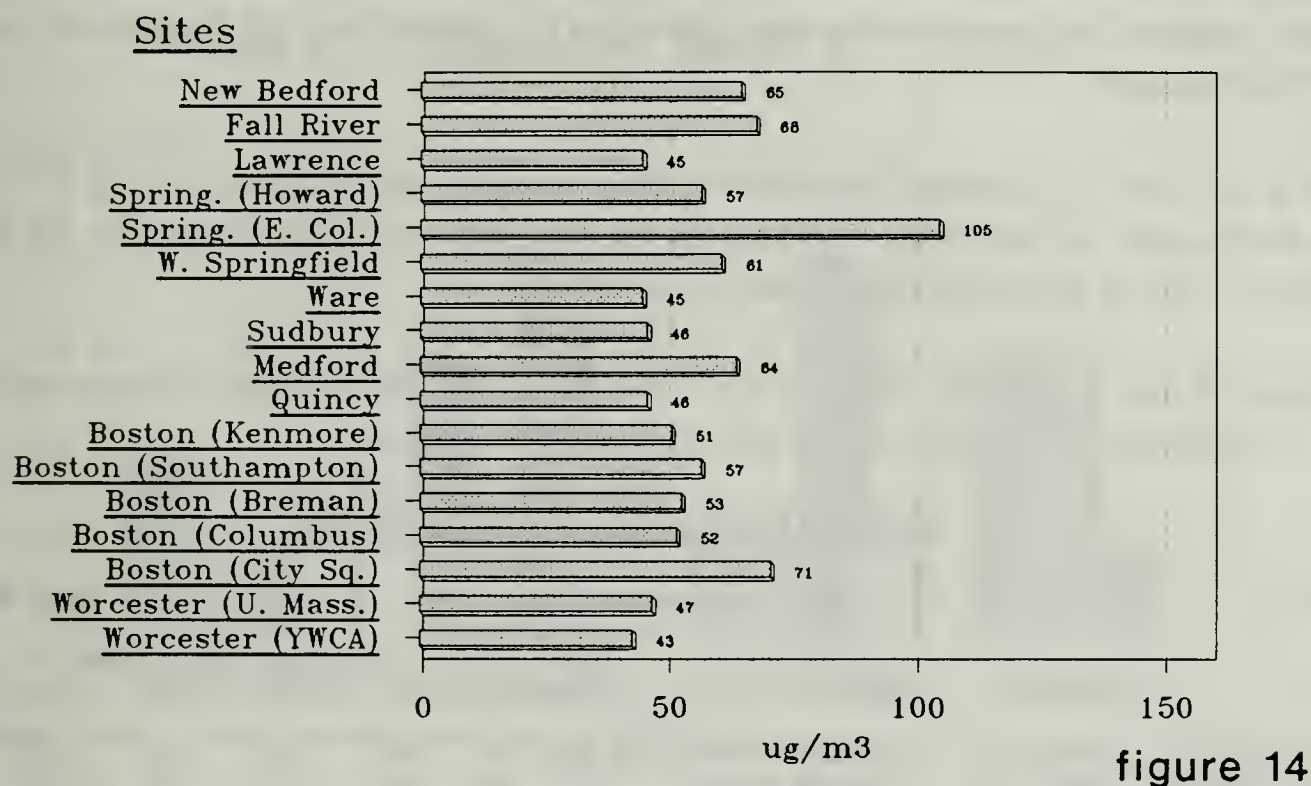
#### ABBREVIATIONS AND SYMBOLS USED IN TABLE 17

SITE ID = AIRS SITE IDENTIFICATION NUMBER POC = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORSAT A SITE)  
MT = MONITOR TYPE (1 = NAMS, 2 = SLAMS, 3 = OTHER) YR = YEAR REP ORG = REPORTING ORGANIZATION NUM OBS = NUMBER OF OBSERVATIONS  
SCHEDULED NUM OBS = NUMBER OF OBSERVATIONS SCHEDULED % OBS = PERCENT COMPLETED OBSERVATIONS (BASED ON NUMBER REQUIRED)  
NUM REQ = THE NUMBER OF OBSERVATIONS REQUIRED FOR 100% MAXIMUM VALUES 1ST,2ND,3RD,4TH = 1ST,2ND,3RD AND 4TH HIGHEST  
24-HOUR VALUES FOR THE YEAR VALS > 150 MEAS = NUMBER OF VALUES GREATER THAN 150 UG/M3 (PM10 STANDARD)  
VALS > 150 EST = NUMBER OF EXPECTED VIOLATIONS WTD ARITH MEAN = WEIGHTED ARITHMETIC MEAN (STANDARD = 50 UG/M3)  
METH = METHOD CODE FOR SAMPLER ? = INDICATES THAT NUMBER OF OBSERVATIONS WERE INSUFFICIENT TO CALCULATE MEAN. THE DATA CAPTURE  
SITE MUST EXCEED 75% FOR EACH QUARTER.



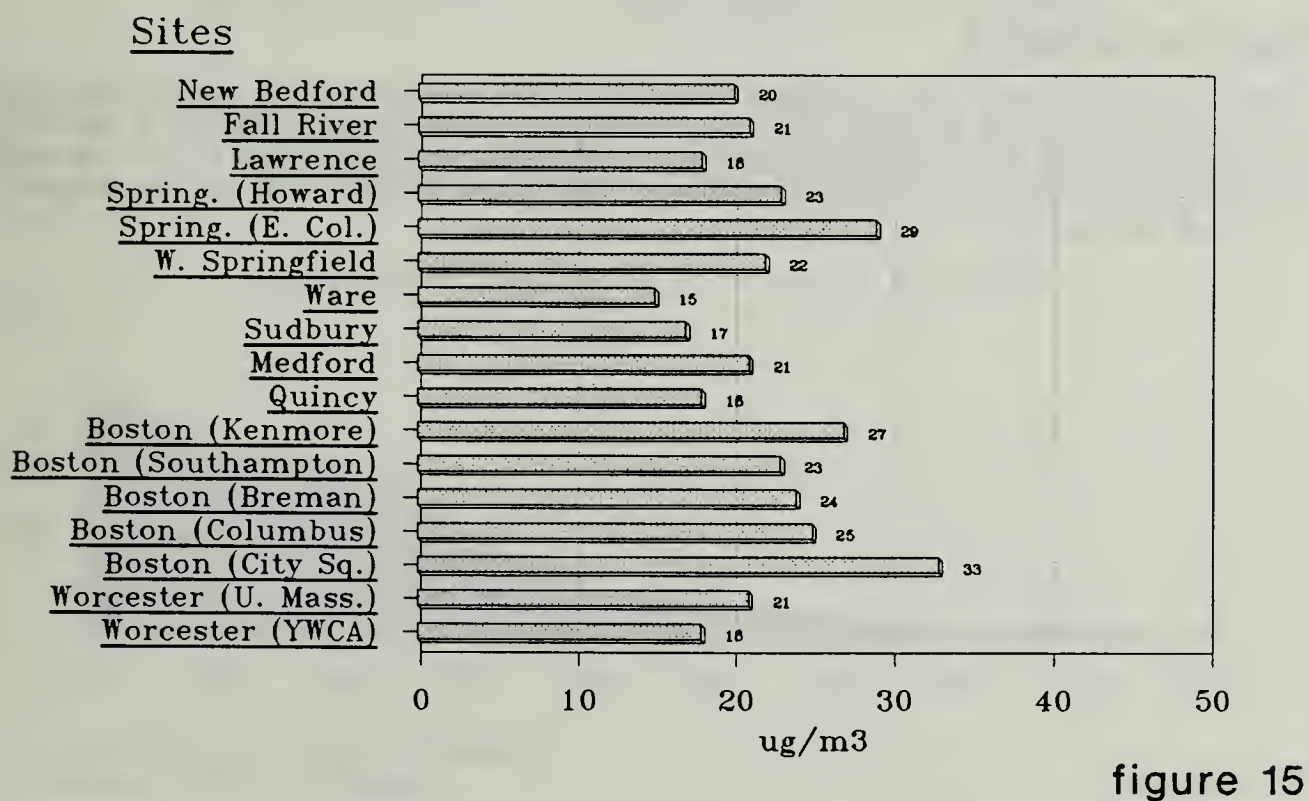
## PM10 Maximum 24 Hour Values

*Standard = 150 ug/m<sup>3</sup>*



## PM10 Arithmetic Means

*Standard = 50 ug/m<sup>3</sup>*



### 3.7 LEAD (Pb) DATA SUMMARY

There were four Pb sites during 1991 in the state operated network. Two sites had collocated samplers (samplers which run simultaneously for precision assessment). All of the sites achieved 75% or greater data capture. The Pb data capture for all sites combined is shown in section 3.10, figure 30 (pg 47).

There were no violations of the Pb air quality standard during the year. The highest calender quarter arithmetic mean was 0.04 ug/m3 at Springfield (E. Columbus Ave.) which is 3% of the standard.

Pb is measured by a manual sampler in which samples are collected during a 24 hour period on an every sixth day schedule. The samples are analyzed for Pb concentration by the Inorganic Chemistry Lab at Lawrence Experiment Station.

Table 18 lists by site the Pb data for 1991 including the number of observations (100% is 60), the quarterly arithmetic means and the maximum values.

**TABLE 18: 1991 PB DATA SUMMARY**

LEAD (12128)			MASSACHUSETTS				UNITS: 001 UG/CU METER (25 C)						
P O M							----QUARTERLY ARITH MEANS----				MEANS	MAX	VALUES
SITE ID	C T	CITY	COUNTY	ADDRESS	REP YR ORG	#OBS	1ST	2ND	3RD	4TH	>1.5	1ST	2ND
25-013-0011	2 1	SPRINGFIELD	HAMPDEN CO	59 HOWARD STREET	91 001	55	.01	.00	.00	.02	0	.06	.06
25-013-0011	3 3	SPRINGFIELD	HAMPDEN CO	59 HOWARD STREET	91 001	54	.02	.01	.01	.01	0	.07	.06
25-013-2007	1 1	SPRINGFIELD	HAMPDEN CO	EAST COLUMBUS AVE	91 001	55	.03	.01	.04	.02	0	.09	.08
25-025-0002	1 1	BOSTON	SUFFOLK CO	KENMORE SQUARE	91 001	58	.01	.01	.04	.01	0	.09	.08
25-025-0027	2 1	BOSTON	SUFFOLK CO	ONE CITY SQUARE	91 001	60	.02	.02	.01	.00	0	.08	.07
25-025-0027	3 3	BOSTON	SUFFOLK CO	ONE CITY SQUARE	91 001	59	.03	.03	.01	.00	0	.10	.08

METHODS:		LEAD (12128)	ANALYSIS METHOD	
CODE		COLLECTION METHOD		
====		=====		=====
092		HI-VOL		ATOMIC ABSORPTION

#### ABBREVIATIONS AND SYMBOLS USED IN TABLE 18

SITE ID = AIRS SITE IDENTIFICATION NUMBER POC = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE)  
MT = MONITOR TYPE (1 = NAMS, 2 = SLAMS, 3 = OTHER) YR = YEAR REP ORG = REPORTING ORGANIZATION # OBS = NUMBER OF OBSERVATIONS  
QUARTERLY ARITH MEANS 1ST,2ND,3RD,4TH = 1ST,2ND,3RD AND 4TH QUARTER ARITHMETIC MEANS MEANS > 1.5 = NUMBER OF QUARTERLY ARITH  
MEANS GREATER THAN 1.5 MICRO-GRAMS PER CUBIC METER (PB STANDARD) MAX VALUES 1ST,2ND = 1ST AND 2ND HIGHEST 24-HOUR VALUES FOR  
THE YEAR METH = METHOD CODE FOR SAMPLER



## Pb Quarterly Arithmetic Means

*Standard = 1.5 ug/m<sup>3</sup>*

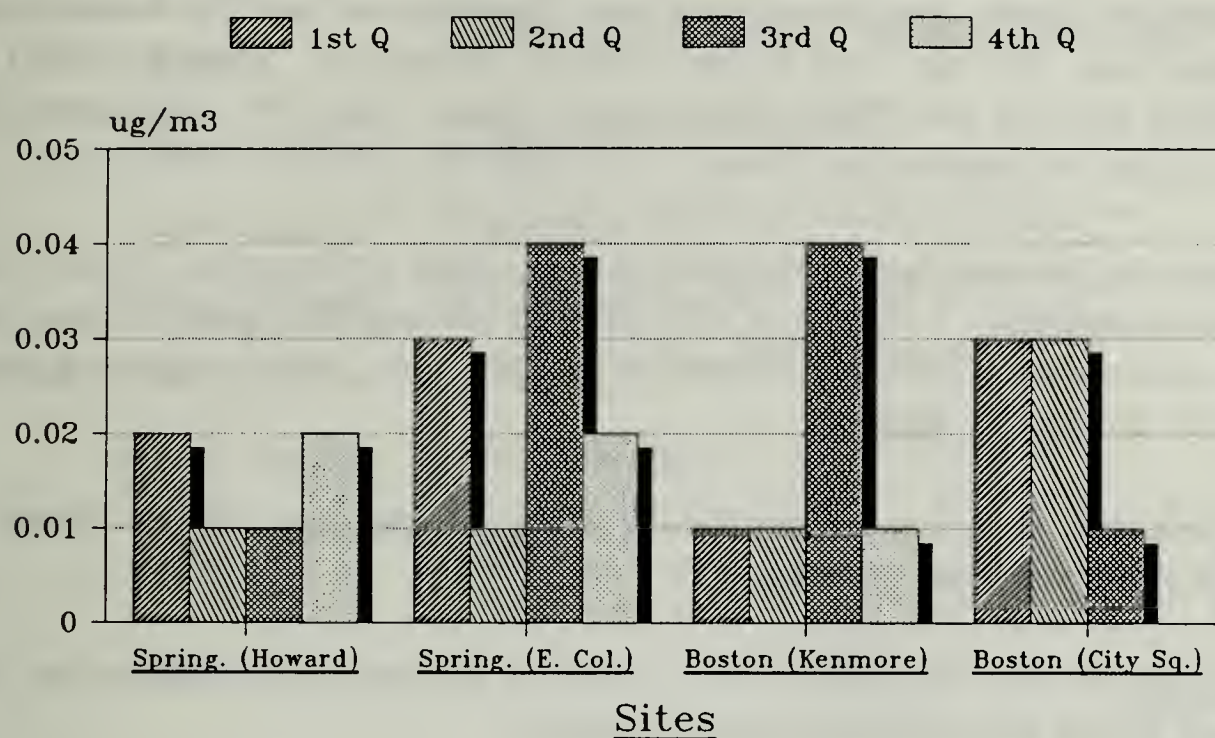
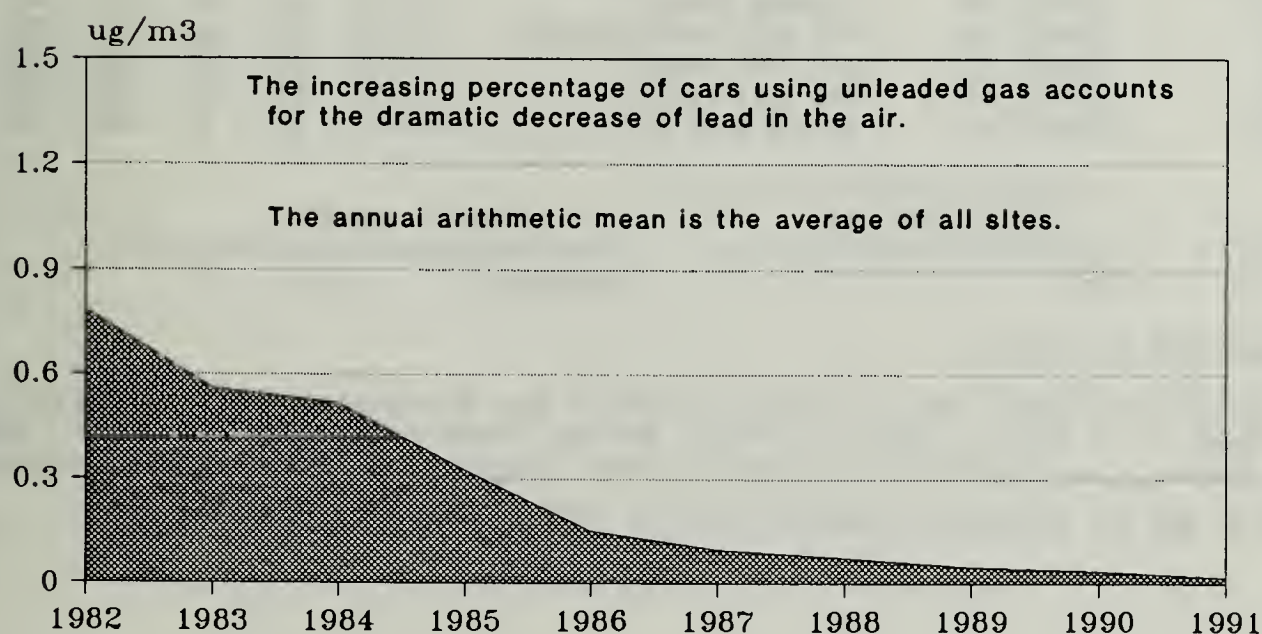


figure 16

## Pb Ten Year Trend

*Annual arithmetic mean of  
Boston and Springfield sites*



Sites are Howard + E. Columbus (Spring.)  
and Kenmore + City Sq. (Boston)

figure 17



### 3.8 TOTAL SUSPENDED PARTICULATE (TSP) DATA SUMMARY

TSP was replaced by PM10 as the particulate air quality standard effective July 31, 1987, and is no longer a criteria pollutant. PM10 was made the particulate standard because it collects particulates which are 10 microns or less. The smaller particulates are more likely to be a health hazard because they can penetrate the respiratory system.

TSP sampling is still conducted at six sites. Maintaining these sites allows for continuity of the data to observe trends. Also, the samples from these sites are used for determining lead (Pb) concentrations and they are used in the National Particulate Network (NPN) for metals analysis. All of the sites had 75% or greater data capture. The TSP data capture for all sites combined is shown in Section 3.10, figure 31 (pg 47).

The former 24-hour standard (150 ug/m3) was exceeded at three sites (Boston - Kenmore Sq. and City Sq.; Springfield - E. Columbus Ave.). The former annual geometric mean standard (75 ug/m3) was also exceeded at Boston (Kenmore Sq.). However, PM10 samplers at these sites did not exceed the air quality standard.

TSP is measured by a manual sampler in which samples are collected during a 24 hour period on an every sixth day schedule.

Table 19 lists by site the TSP data for 1991 including the number of observations (100% is 61), the maximum values and the and geometric means.

**TABLE 19: 1991 TSP DATA SUMMARY**

TOTAL SUSPENDED PARTICULATE (11101)					MASSACHUSETTS			UNITS: 001 UG/CU METER (25 C)						
SITE ID	P O M		CITY	COUNTY	ADDRESS	YR	REP ORG	#OBS	--MAXIMUM 24-HR VALUES--				ARITH MEAN	GEO MEAN
	C	T							1ST	2ND	3RD	4TH		
25-013-0011	1	2	SPRINGFIELD	HAMPDEN CO	59 HOWARD STREET	91	001	57	106	94	87	72	44	4
25-013-0011	2	3	SPRINGFIELD	HAMPDEN CO	59 HOWARD STREET	91	001	54	105	91	89	74	44	4
25-013-2007	1	3	SPRINGFIELD	HAMPDEN CO	EAST COLUMBUS AVENUE	91	001	55	164	142	139	132	70	6
25-025-0002	1	3	BOSTON	SUFFOLK CO	KENMORE SQUARE	91	001	60	154	147	147	143	76	7
25-025-0012	1	2	BOSTON	SUFFOLK CO	115 SOUTHAMPTON STREET	91	001	56	140	134	131	82	54	5
25-025-0027	1	2	BOSTON	SUFFOLK CO	ONE CITY SQUARE	91	001	60	151	150	128	125	69	6
25-025-0027	2	3	BOSTON	SUFFOLK CO	ONE CITY SQUARE	91	001	59	154	136	135	119	67	6
25-025-1003	1	2	CHELSEA	SUFFOLK CO	POWDER HORN HILL	91	001	58	91	86	82	72	38	3
METHODS:														
		CODE		SUSPENDED PARTICULATE (11101)						ANALYSIS METHOD				
		=====		COLLECTION METHOD						=====				
		091		HI-VOL						GRAVIMETRIC				

#### ABBREVIATIONS AND SYMBOLS USED IN TABLE 19

SITE ID = AIRS SITE IDENTIFICATION NUMBER POC = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE)  
MT = MONITOR TYPE (1 = NAMS, 2 = SLAMS, 3 = OTHER) YR = YEAR REP ORG = REPORTING ORGANIZATION # OBS = NUMBER OF OBSERVATION  
MAXIMUM VALUES 1ST,2ND,3RD,4TH = 1ST,2ND,3RD AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR ARITH MEAN = ARITHMETIC MEAN  
GEO MEAN = GEOMETRIC MEAN GEO STD = GEOMETRIC STANDARD DEVIATION METH = METHOD CODE FOR SAMPLER

# TSP Data Summary

## *No Standards*

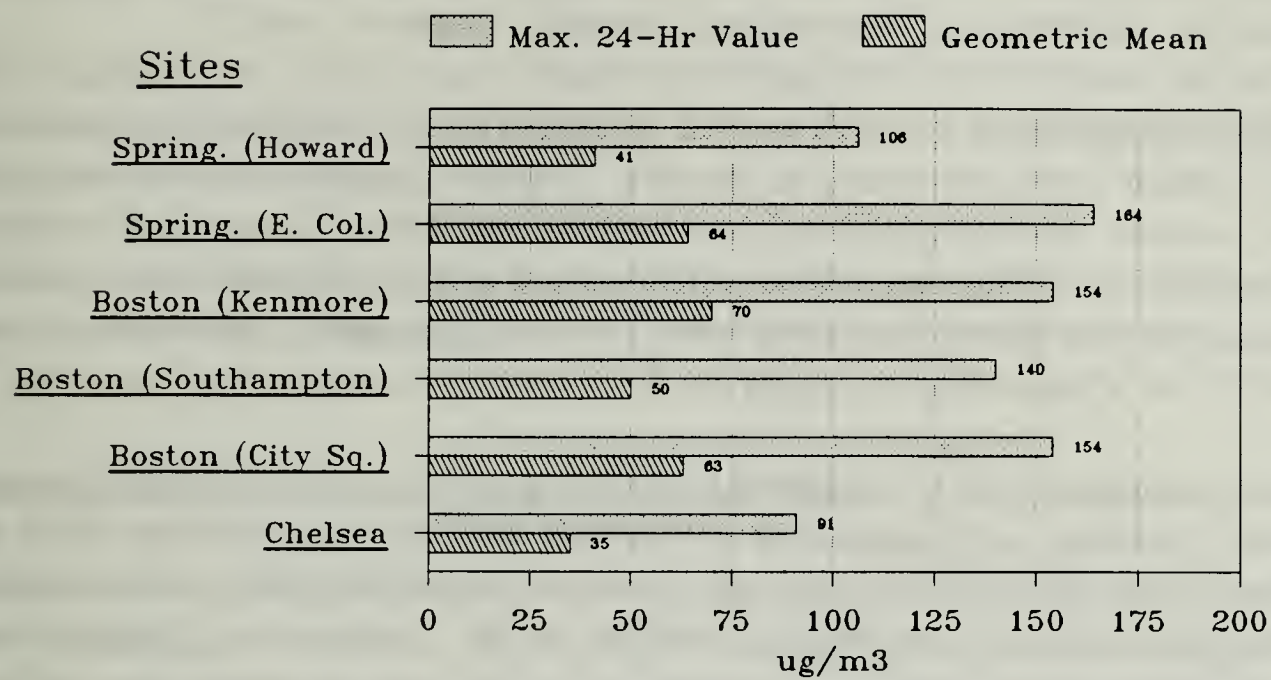


figure 18

The former TSP standards were 150  $\mu\text{g}/\text{m}^3$  for 24 hours and 75  $\mu\text{g}/\text{m}^3$  for the geometric mean.



### 3.9 QUALITY CONTROL AND QUALITY ASSURANCE

The standard operating procedures (SOPs) used to generate the data in this report include quality control (QC) and quality assurance (QA) techniques which document the precision and accuracy of the submitted data.

The requirements, techniques and goals of a QC/QA program are described in the U.S. Code of Federal Regulations (CFR), title 40, part 58 and in the U.S. EPA "Quality Assurance Handbook for Air Pollution Measurement Systems", Volumes 1 and 2.

Quality Control (QC) is comprised of those activities performed by personnel who are directly involved in the generation of the data. Examples of personnel who would perform QC functions are site operators and laboratory support personnel. QC activities include functions such as performing calibrations, data validation and performing performance checks to assess the precision of ambient air analyzers and samplers. Precision is defined as a measure of the repeatability of a measurement system.

Quality Assurance (QA) is comprised of those activities performed by personnel who are not directly involved in the generation of the data and who may therefore make an unbiased assessment of the quality of the data. QA activities include functions such as performing site inspections and conducting performance audit checks to assess the accuracy of ambient air analyzers and samplers. Accuracy is defined as a measure of closeness of an observed measurement value to the truth.

#### Requirements and Techniques for Performing Precision and Accuracy Checks

Precision and accuracy of air quality data cannot be determined by examining the data itself, but requires the use of specific operator and auditor checks from which precision and accuracy can be assessed.

The requirements and techniques for performing precision and accuracy checks is set forth by the U.S. EPA as described in 40 CFR, Part 58, Appendix A. A condensed description of the requirements and techniques for performing precision and accuracy checks follows.

#### Precision and Accuracy for Automated Methods (continuous data)

Automated methods are used for monitoring pollutants (SO<sub>2</sub>, NO<sub>2</sub>, O<sub>3</sub>, CO) for which continuous analyzers perform the measurement.

Precision is assessed by performing a one-point check at least once every two weeks. The precision check is made by challenging the analyzer with a known concentration of gas between 0.080 and 0.100 ppm for SO<sub>2</sub>, NO<sub>2</sub> and O<sub>3</sub> analyzers, and between 8.0 and 10.0 ppm for CO analyzers.



Accuracy is assessed by performance audits which challenge the analyzer with audit gas of different concentration levels so that the analyzer response is tested throughout its measurement range.

#### Precision and Accuracy for Manual Methods (non-continuous data)

Manual methods are used for monitoring pollutants (PM10, TSP and Pb) for which non-continuous samplers perform the measurement.

Precision is assessed by selecting one or more monitoring sites for collocated sampling. The collocated samplers run together during sampling periods. The measurements of each sampler are compared to calculate precision.

The accuracy of manual sampling methods is assessed by auditing a portion of the measurement process. For PM10 and TSP the flow-rate during sample collection is audited. For Pb the flow-rate and analytical method are both audited.

#### Calculation and Meaning of Precision and Accuracy Statistics

The analyzer and sampler percent differences obtained from QC and QA checks are used to assess the precision and accuracy of the data being generated in the sampling network. Precision and accuracy are given in the context of lower and upper 95 percentile limits. The calculated values for the lower and upper 95 percentile limits are given in units of percentage for each parameter.

The meaning of the 95 percentile limits is that 95% of the data obtained for each parameter is estimated to be precise and accurate to within the percentage range defined by the lower and upper limits. As an example, if the lower and upper 95 percentile limits for a parameter based upon precision checks are calculated to be -7.4% and +4.3%, then 95% of the data for that parameter is precise to within the range of -7.4% through +4.3%.

#### 95 Percentile Limit Goals

The QC/QA procedures are designed to obtain data which is of known and acceptable precision and accuracy. As a goal, the 95 percentile probability limits for precision (all parameters) and PM10 and TSP accuracy should be less than  $\pm 15\%$ . The 95 percentile probability limits for accuracy for all other parameters should be less than  $\pm 20\%$ .

The 1992 precision and accuracy data summary is listed in Table 20 on the following page.

**TABLE 20: 1991 PRECISION AND ACCURACY DATA**

CONTINUOUS ANALYZERS						P R E C I S I O N   D A T A				A C C U R A C Y   D A T A										
PRECISION-ACCURACY DATA KEY						# OF ANLYZRS	PRECIS CHECKS	PROB LIM		LOC STD SOURCE	TYP AUD	# AUDITS L1-3 L4	PROB LIM		PROB LIM LO-L2-UP	PROB LIM LO-L3-UP				
RG	ST	RO	TYP	POLL	YR-Q			LO	UP				LO-L1-UP							
01	25	001	C	42101	91	8	202	-05	+06			16	0	-06	+07	-06	+06	-08	+07	
CARBON MONOXIDE (CO)						91-1	8	48	-05	+06			0	0						
					91-2	8	53	-05	+06	A	1	7	0	-02	+06	-05	+07	-07	+09	
					91-3	8	48	-04	+05			0	0							
					91-4	8	53	-03	+05	A	1	9	0	-10	+10	-11	+10	-11	+11	
01	25	001	C	42401	91	12	274	-08	+06			22	0	-11	+01	-10	+02	-11	+02	
SULFUR DIOXIDE (SO2)						91-1	11	68	-06	+05	A	1	6	0	-15	+08	-14	+08	-15	+08
					91-2	12	70	-08	+04	A	1	5	0	-16	+02	-16	+05	-16	+04	
					91-3	11	65	-07	+05	A	1	6	0	-16	+02	-12	+03	-12	+02	
					91-4	11	71	-05	+07	A	1	5	0	-12	+06	-06	-01	-07	-01	
01	25	001	C	42602	91	6	140	-11	+08			13	0	-02	+08	+00	+05	-02	+05	
NITROGEN DIOXIDE (NO2)						91-1	6	35	-09	+07	A	1	3	0	-03	+20	-02	+14	-03	+17
					91-2	6	35	-11	+07	A	1	3	0	-11	+21	-11	+14	-11	+13	
					91-3	6	36	-10	+07	A	1	3	0	-03	+05	-05	+07	-04	+01	
					91-4	6	34	-12	+09	A	1	4	0	-03	+06	-06	+09	-06	+06	
01	25	001	C	44201	91	15	242	-09	+06			32	0	-10	+04	-08	+04	-08	+04	
OZONE (O3)						91-1	3	18	-13	+03	F	1	2	0	-06	+01	-06	+04	-10	+06
					91-2	15	88	-07	+04	F	2	7	0	-18	+08	-16	+06	-17	+07	
					91-3	15	93	-08	+05	F	2	16	0	-12	+06	-09	+04	-09	+04	
					91-4	15	43	-09	+07	F	1	7	0	-02	+02	-01	+01	-02	+02	

NON-CONTINUOUS ANALYZERS						P R E C I S I O N   D A T A				A C C U R A C Y   D A T A									
PRECISION-ACCURACY DATA KEY						# OF SMPLS	COLLC SITES	PROB LIM		COLL SAMP BELOW LIM	VAL COLL DATA PRS	LOC STD SOURCE	TYP AUD	#AUDITS	PROB LIM		PROB LIM LO-L2-UP	PROB LIM LO-L3-UP	
RG	ST	RO	TYP	POLL	YR-Q			LO	UP						LO-L1-UP				
01	25	001	I	11101	91	113	2	-12	+10	3	110	M	1	28			-03	+04	
TSP						91-1	28	2	-17	+14	0	28	P	1	8			-04	+05
					91-2	28	2	-08	+08	1	27	M	1	8			-05	+06	
					91-3	29	2	-09	+07	1	28			0					
					91-4	28	2	-12	+10	1	27	M	1	12			-06	+05	
01	25	001	I	12128	91	14	2			106	0	X	1	11					
LEAD (Pb)						91-1	7	2		27	0			0					
					91-2	5	2			23	0	X	1	6					
					91-3	1	2			28	0			0					
					91-4	1	2			28	0	X	1	5					
01	25	001	I	81102	91	158	3	-10	+06	56	102	P	1	68			-03	+06	
PM10 TOTAL 0-10UM						91-1	40	3	-11	+06	17	23	P	1	21			-02	+09
					91-2	44	3	-06	+06	18	26	M	1	17			-03	+07	
					91-3	35	3	-12	+04	13	22	M	1	20			-08	+07	
					91-4	39	3	-11	+07	8	31	M	1	10			-06	+05	

**ABBREVIATIONS AND SYMBOLS USED IN TABLE 18:**

RG = EPA REGION ST = STATE RO = REPORTING ORGANIZATION TYP = ANALYZER TYPE (CONTINUOUS OR NON-CONTINUOUS) YR = YEAR  
 # OF ANALYZRS = NUMBER OF ANALYZERS PRECIS CHECKS = NUMBER OF PRECISION CHECKS PROB LIM LO/UP = LOWER AND UPPER  
 95% PROBABILITY LIMITS LOC STD SOURCE = AUDIT GAS SOURCE TYP AUD = AUDIT TYPE (1 = DONE BY REPORT ORG) # AUDITS = NUMBER OF  
 AUDITS PROB LIM LO-L1-UP = LOWER AND UPPER 95% PROBABILITY LIMITS AT LOW RANGE PROB LIM LO-L2-UP = LOWER AND UPPER 95%  
 PROBABILITY LIMITS AT MIDDLE RANGE PROB LIM LO-L3-UP = LOWER AND UPPER 95% PROBABILITY LIMITS AT HIGH RANGE # OF SMPLS = NUM  
 OF SAMPLERS COLLC SITES = NUMBER OF COLLOCATED SITES COLL SAMP BELOW LIM = NUMBER OF COLLOCATED SAMPLES BELOW THE LIMIT  
 PRECISION CALCULATION VAL COLL DATA PRS = NUMBER OF VALID COLLOCATED SAMPLES (ABOVE THE LIMIT USED FOR PRECISION CALCULATION)

**PRECISION DATA:** Acceptable lower and upper 95% probability limits are within  $\pm 15\%$ .

**ACCURACY DATA:** Acceptable lower and upper 95% probability limits are within  $\pm 15\%$  for TSP, Pb and PM10. For CO, SO2, NO2 and O3 acceptable limits are within  $\pm 20\%$ .

# 1991 Precision Summary

*Upper and lower 95%  
probability limits*

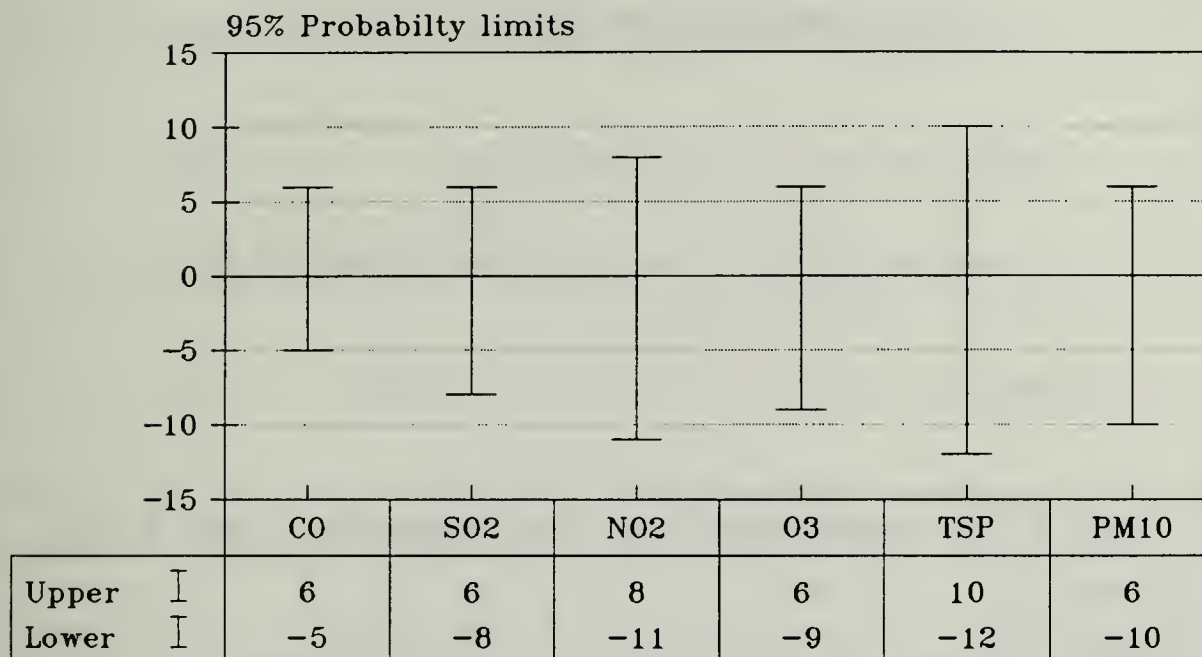


figure 19

# 1991 CO Accuracy Summary

*Upper and lower 95%  
probability limits*

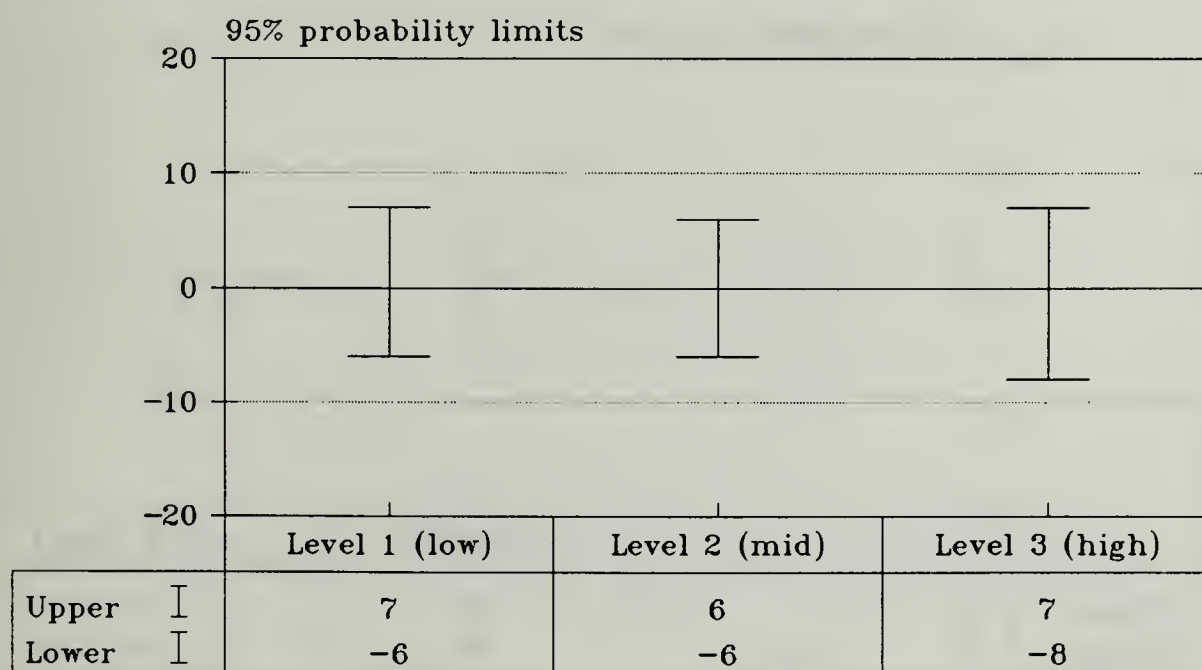


figure 20



# 1991 N02 Accuracy Summary *Upper and lower 95% probability limits*

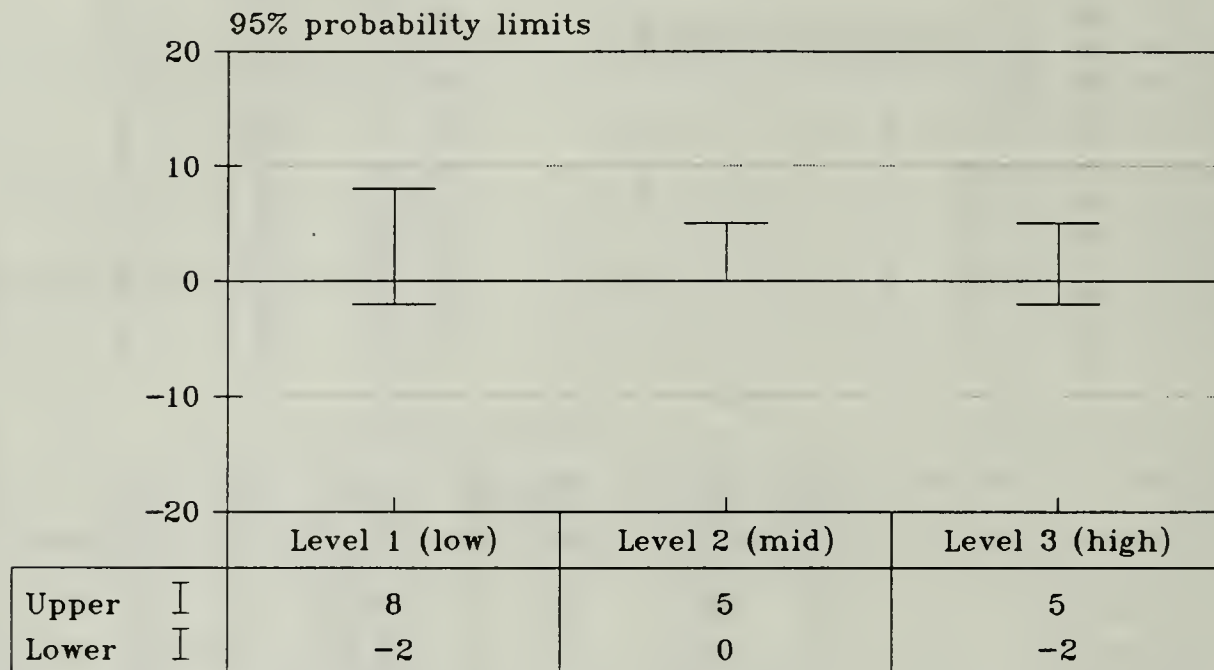


figure 21

# 1991 03 Accuracy Summary *Upper and lower 95% probability limits*

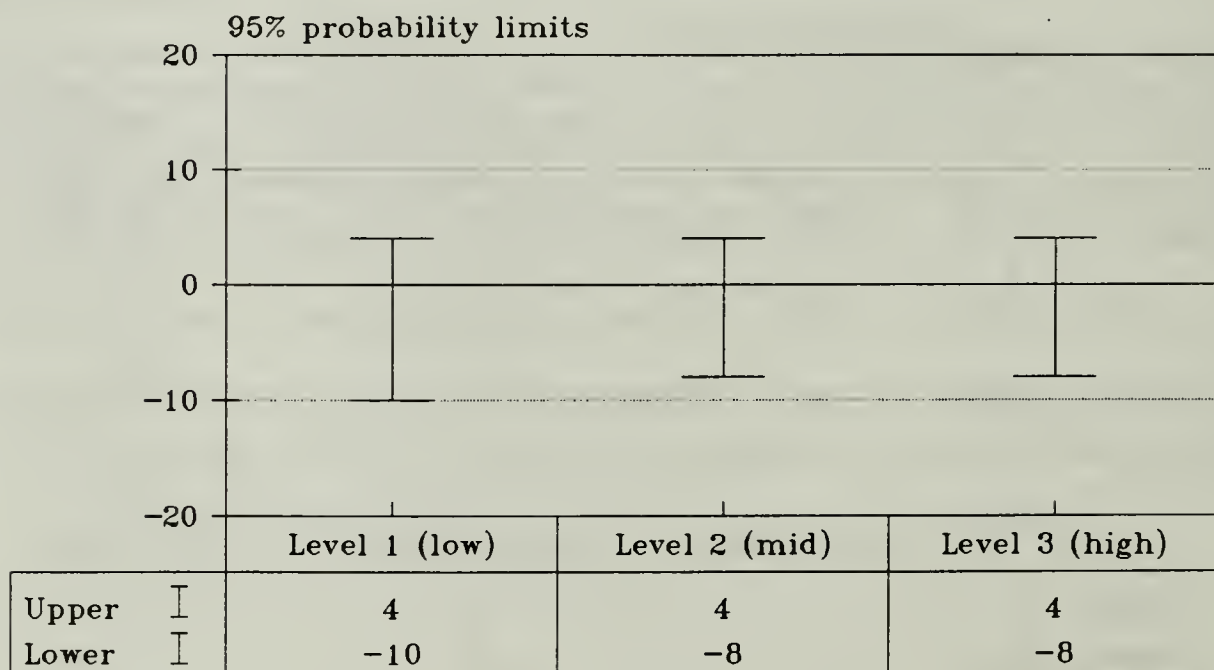


figure 22

## 1991 SO<sub>2</sub> Accuracy Summary

*Upper and lower 95%  
probability limits*

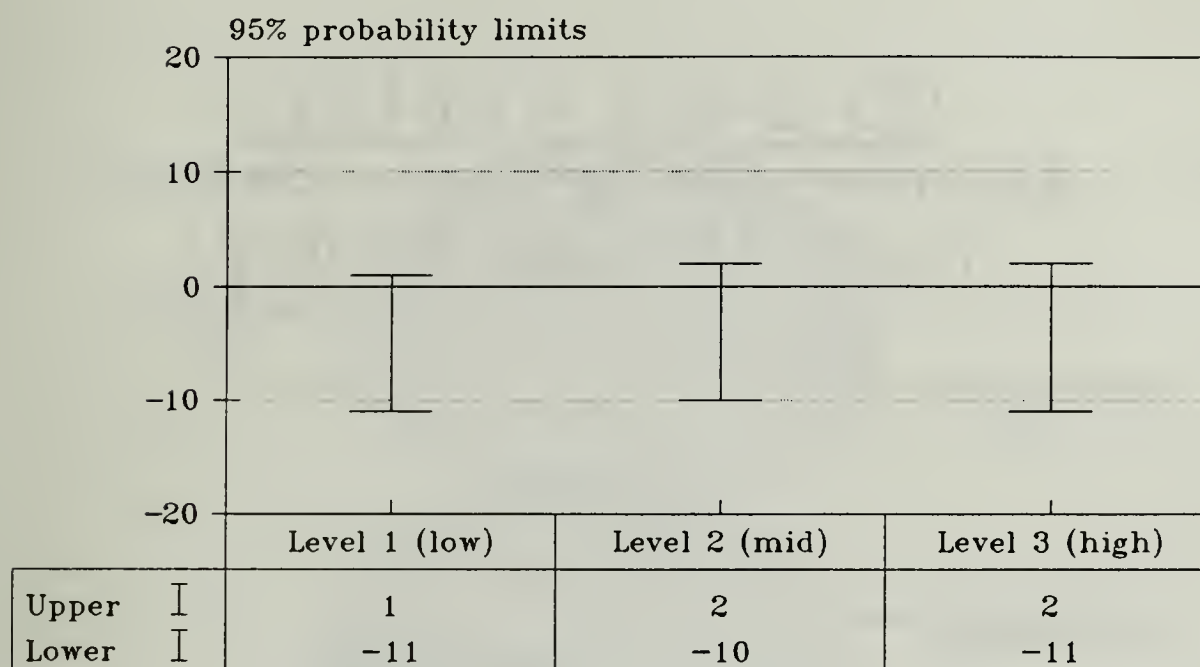


figure 23

## PM<sub>10</sub> + TSP Accuracy Summary

*Upper and lower 95%  
probability limits*

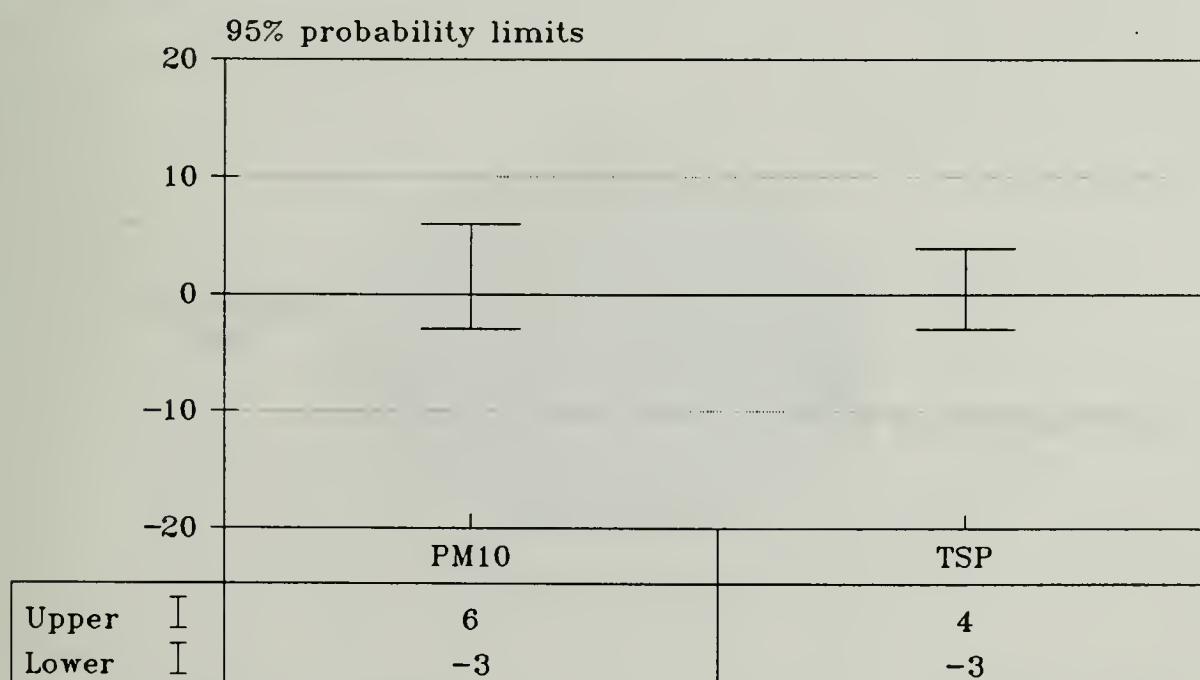


figure 24

### 3.10 DATA CAPTURE

Acceptable data capture for regulatory purposes requires that 75% of the possible data be collected. Due to sound quality control practices and the diligence of the field analysts the goal was met for 97% of the monitors. The following Figures show the combined data capture for each parameter.

## O3 Data Capture *All sites during Ozone Season (April through October)*

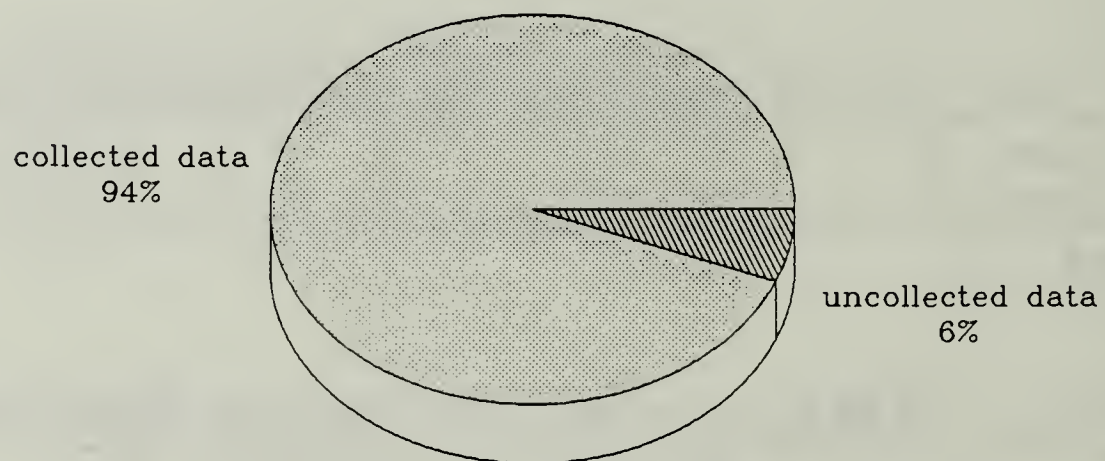


figure 25



## S02 Data Capture *For all sites during 1991*

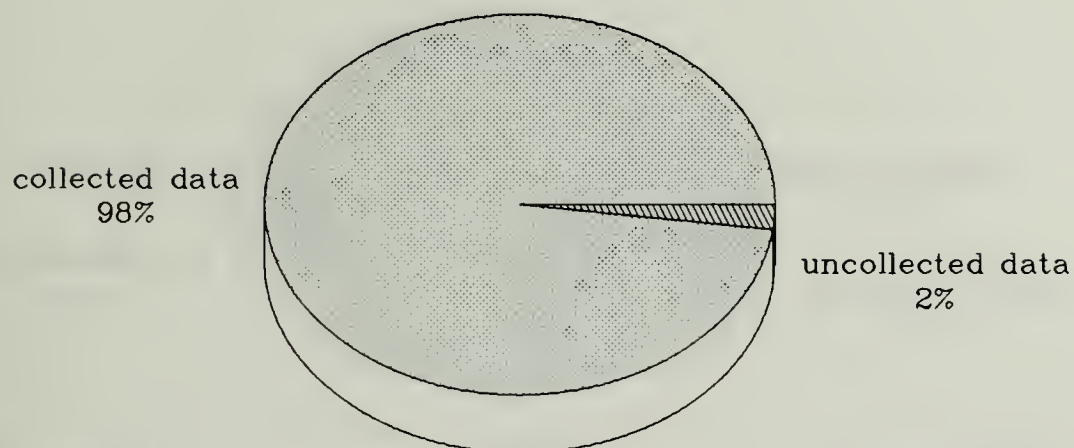


figure 26

## N02 Data Capture *For all sites during 1991*

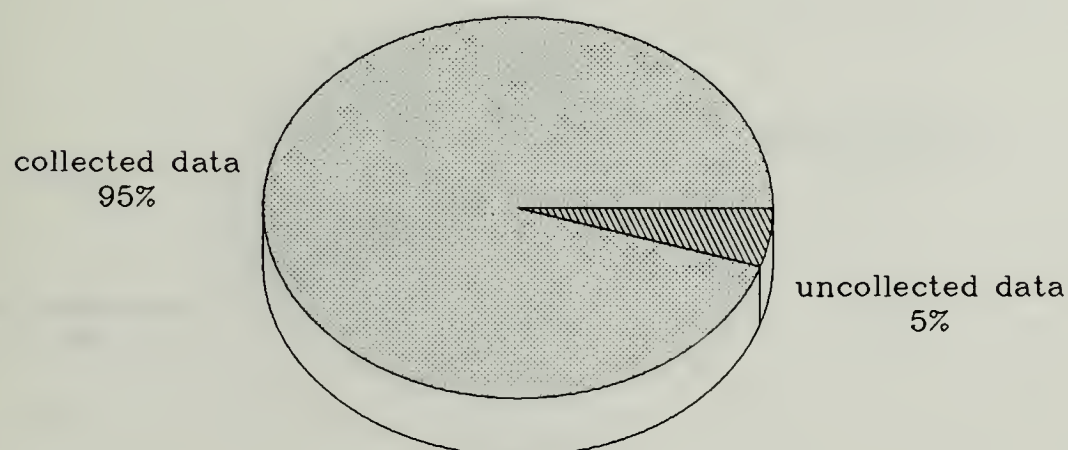


figure 27

## CO Data Capture

*For all sites during 1991*

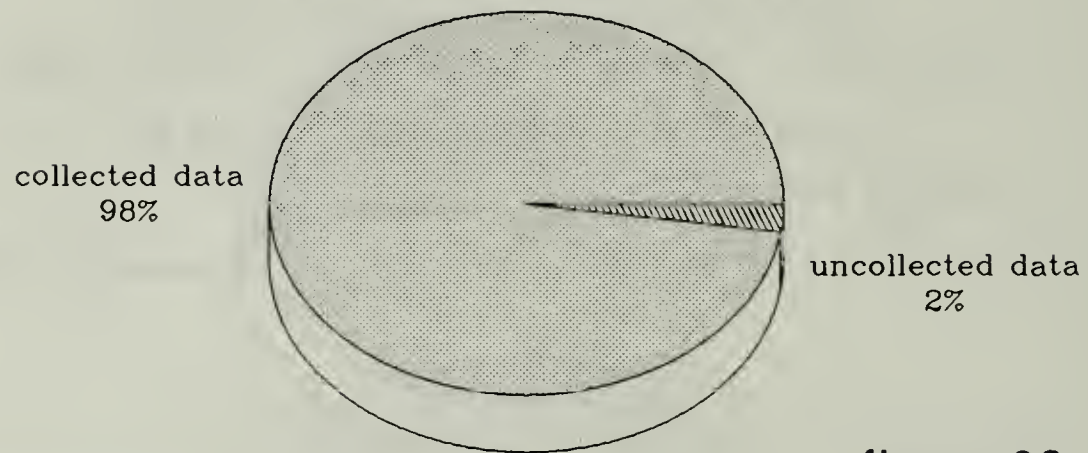


figure 28

## PM10 Data Capture

*For all sites during 1991*

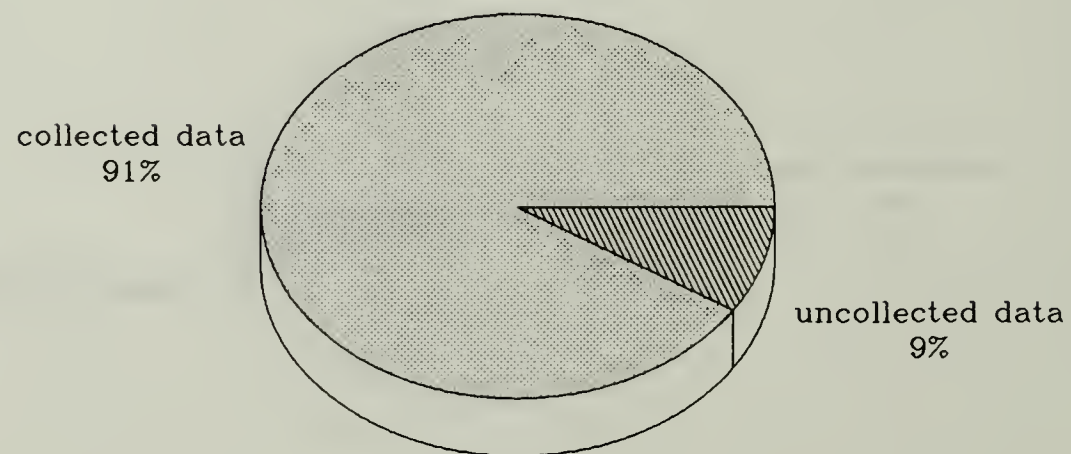


figure 29

## Pb Data Capture *For all sites during 1991*

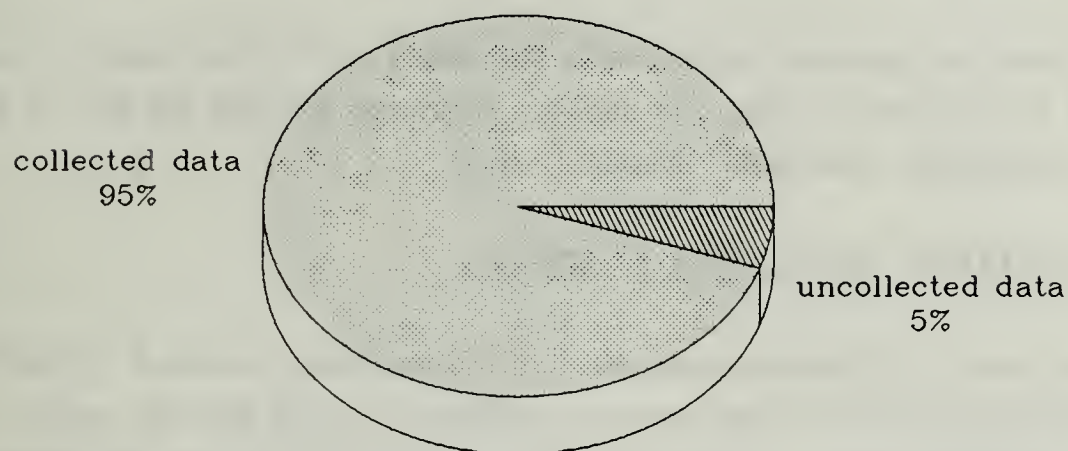


figure 30

## TSP Data Capture *For all sites during 1991.*

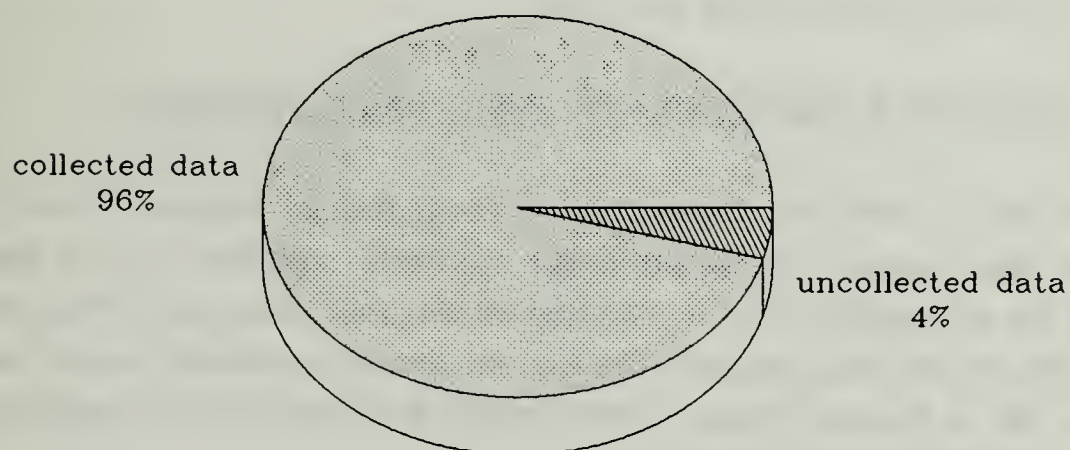


figure 31



## 4. AMBIENT AIR QUALITY DATA - INDUSTRIAL NETWORK

### 4.1 INTRODUCTION

The industrial ambient air quality network is comprised of monitoring stations operated by industries with facilities that potentially may emit large amounts of criteria pollutants. An example would be a coal burning power plant which would produce SO<sub>2</sub>. The monitoring stations in the industrial network are sited to measure the maximum values from the specific point source. For a power plant, when the pollutant (SO<sub>2</sub>) value reaches certain trigger values the power plant switches to a lower sulfur content fuel. Because of the different siting criteria the measured values for the industrial stations may be higher than for the public stations.

The data from the industrial network is submitted to the Air Quality Surveillance Branch (AQSB). After it has gone through the quality assurance process the data is submitted into the Aerometric Information Retrieval System (AIRS).

### 4.2 SULFUR DIOXIDE (SO<sub>2</sub>) DATA SUMMARY

There were twenty SO<sub>2</sub> sites during 1991 in the industrial network. All of the sites achieved 75% or greater data capture. There were no violations of the SO<sub>2</sub> air quality standards during the year. The highest annual arithmetic mean was 0.012 ppm at the Boston Edison sites in Boston (Breman St. and Atlantic Ave.) which is 40% of the standard. The highest 24-hour value was 0.068 ppm at the General Electric site located in Lynn which is 49% of the standard. The highest 3-hour value was 0.176 ppm at the New England Power Co. site in Swansea which is 35% of the standard. Table 21 lists by site the SO<sub>2</sub> summary data for 1991.

### 4.3 NITROGEN DIOXIDE (NO<sub>2</sub>) DATA SUMMARY

There were four NO<sub>2</sub> sites during 1991 in the industrial network. All of the sites achieved 75% or greater data capture. There were no violations of the NO<sub>2</sub> air quality standard during the year. The highest annual arithmetic mean was 0.024 ppm at the Medical Area Total Energy Project (MATEP) site located in Brookline (Route 9) which is 45% of the standard. Table 22 lists by site the NO<sub>2</sub> summary data for 1991.

### 4.4 TOTAL SUSPENDED PARTICULATE (TSP) DATA SUMMARY

There were twelve TSP sites during 1991 in the industrial network. All of the sites achieved 75% or greater data capture. TSP is no longer a criteria pollutant (it was replaced by PM<sub>10</sub> in 1987) so there are no standards for it. The highest 24-hour value was 139 ug/m<sup>3</sup> at the Wellesley site which is 93% of the old standard. The highest annual arithmetic mean was 54 ug/m<sup>3</sup> at the Boston Edison site in Boston (Atlantic Ave.) which is 72% of the old standard. Table 23 lists by site the TSP summary data for 1991.

#### 4.5 SULFATE (SO<sub>4</sub>) DATA SUMMARY

There were nine SO<sub>4</sub> sites during 1991 in the industrial network. All of the sites achieved 75% or greater data capture. There are no standards for SO<sub>4</sub> since it is not a criteria pollutant. The highest 24-hour value was 34.0 ug/m<sup>3</sup> at the Pioneer Valley TSP Group site in Springfield (Rose Street). The highest annual arithmetic mean value was 10.34 ug/m<sup>3</sup> at the Boston Edison site in Boston (Atlantic Ave.). Table 24 lists by site the SO<sub>4</sub> data summary for 1991.

**TABLE 21: 1991 INDUSTRIAL NETWORK SO2 DATA SUMMARY**

SULFUR DIOXIDE (42401)				MASSACHUSETTS				UNITS: 007 PPM								
SITE ID	P	CITY	COUNTY	ADDRESS	YR	REP ORG	#OBS	MAX 24-HR		OBS		MAX 3-HR		OBS		AR ME
	O M							1ST	2ND	> 0.14	1ST	2ND	> 0.50	1ST	2ND	
25-005-0010	1 4	FALL RIVER	BRISTOL CO	BETWEEN GLOBE AND	91	017	8692	.055	.052	0	.125	.114	0	.200	.162	.0
25-005-6001	1 4	SWANSEA	BRISTOL CO	SHARPS LOT ROAD	91	017	8642	.045	.034	0	.176	.127	0	.296	.269	.0
25-009-1004	1 4	PEABODY	ESSEX CO	HILLTOP AT END OF	91	026	7765	.030	.029	0	.060	.052	0	.079	.072	.0
25-009-1005	1 4	PEABODY	ESSEX CO	PERKINS STREET PL	91	026	7988	.033	.031	0	.119	.081	0	.177	.136	.0
25-009-2003	1 4	LYNN	ESSEX CO	436 LYNNWAY	91	010	7567	.068	.057	0	.114	.105	0	.149	.142	.0
25-009-3003	1 4	MARBLEHEAD	ESSEX CO	WATER TOWER, GREE	91	017	8692	.040	.032	0	.077	.076	0	.114	.114	.0
25-009-5004	1 4	HAVERHILL	ESSEX CO	NETTLE SCHOOL, BO	91	002	8625	.021	.018	0	.036	.036	0	.093	.056	.0
25-013-1005	1 4	HOLYOKE	HAMPDEN CO	MOUNT TOM POWER P	91	900	7989	.026	.024	0	.110	.062	0	.124	.121	.0
25-013-1009	2 4	SPRINGFIELD	HAMPDEN CO	LONGHILL STREET S	91	900	7918	.036	.033	0	.062	.052	0	.093	.083	.0
25-013-1010	1 4	SPRINGFIELD	HAMPDEN CO	CAREW STREET SUBS	91	900	8011	.046	.037	0	.074	.070	0	.113	.110	.0
25-013-5002	1 4	WEST SPRINGFIE	HAMPDEN CO	W. SPRINGFIELD PO	91	900	8062	.037	.033	0	.077	.076	0	.102	.099	.0
25-015-1002	1 4	HADLEY	HAMPSHIRE CO	SUMMIT HOUSE, MOU	91	900	7585	.029	.028	0	.080	.067	0	.151	.148	.0
25-015-2001	1 4	HADLEY	HAMPSHIRE CO	HOPKINS ACADEMY,	91	900	8096	.041	.037	0	.099	.095	0	.139	.129	.0
25-015-3002	1 4	SOUTH HADLEY	HAMPSHIRE CO	PINE STREET SUBST	91	900	8073	.031	.028	0	.067	.066	0	.110	.094	.0
25-017-1701	1 4	STONEHAM	MIDDLESEX CO	HILL STREET	91	025	8494	.027	.026	0	.057	.052	0	.068	.066	.0
25-021-5001	1 4	WELLESLEY	NORFOLK CO	WELLESLEY COLLEGE	91	032	8015	.026	.026	0	.119	.061	0	.194	.155	.0
25-025-0018	1 4	BOSTON	SUFFOLK CO	476 ATLANTIC AVEN	91	005	8325	.041	.036	0	.066	.060	0	.088	.073	.0
25-025-0019	1 4	BOSTON	SUFFOLK CO	LONG ISLAND, BOST	91	005	8222	.027	.026	0	.059	.041	0	.070	.069	.0
25-025-0020	1 4	BOSTON	SUFFOLK CO	DEWAR STREET, DOR	91	005	8329	.058	.032	0	.094	.094	0	.106	.105	.0
25-025-0021	2 4	BOSTON	SUFFOLK CO	340 BREMAN STREET	91	005	8329	.036	.034	0	.063	.060	0	.099	.089	.0

METHODS:		SULFUR DIOXIDE (42401)		ANALYSIS METHOD	
		CODE	COLLECTION METHOD		
		=====	=====		
		000	MULTIPLE METHODS	MULTIPLE METHODS	
		009	INSTRUMENTAL	PULSED FLUORESCENT	
		039	INSTRUMENTAL	ULTRA VIOLET STIMULATED FLUORESCNC	
		060	INSTRUMENTAL	PULSED FLUORESCENT	

**ABBREVIATIONS AND SYMBOLS USED IN TABLE 21**

SITE ID = AIRS SITE IDENTIFICATION NUMBER POC = PARAMETER OCCURENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE)  
MT = MONITOR TYPE (4 = INDUSTRIAL) YR = YEAR REP ORG = REPORTING ORGANIZATION #OBS = NUMBER OF HOUR OBSERVATIONS  
MAX 24-HR, MAX 3-HR, MAX 1-HR 1ST 2ND = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED  
OBS > .14 = NUMBER OF 24-HR AVG. GREATER THAN 0.14 PPM (24-HR STANDARD) OBS > .50 = NUMBER OF 3-HR AVG. GREATER THAN 0.50 PPM (3-HR STANDARD) ARIT MEAN = ARITHMETIC MEAN (STANDARD = 0.030 PPM) METH = METHOD CODE FOR ANALYZER



**TABLE 22: 1991 INDUSTRIAL NETWORK NO2 DATA SUMMARY**

NITROGEN DIOXIDE (42602)			MASSACHUSETTS			UNITS: 007 PPM					
P	O M					REP	MAX	1-HR	MAX	24-HR	ARIT
C T CITY	COUNTY	ADDRESS	YR	ORG	#OBS	1ST	2ND	1ST	2ND	MEAN	METH
108 1 4	BROOKLINE	NORFOLK CO	FISHER RESERVOIR, FISHER A	91	030 8270	.074	.071			.017	000
109 1 4	BROOKLINE	NORFOLK CO	RTE 9 AND CHESTNUT HILL AV	91	030 8734	.107	.084			.024	000
135 1 4	BOSTON	SUFFOLK CO	300 LONGWOOD AVE CHILDRENS	91	030 8732	.090	.089			.023	000
136 1 4	BOSTON	SUFFOLK CO	SW CORNER OF BROOKLINE AVE	91	030 8740	.079	.079			.022	000

CODE	NITROGEN DIOXIDE (42602) COLLECTION METHOD	ANALYSIS METHOD
====	=====	=====
000	MULTIPLE METHODS	MULTIPLE METHODS

**NOTES AND SYMBOLS USED IN TABLE 22**

AIR SITE IDENTIFICATION NUMBER POC = PARAMETER OCCURENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE)  
 OR TYPE (4 = INDUSTRIAL) YR = YEAR REP ORG = REPORTING ORGANIZATION #OBS = NUMBER OF HOUR OBSERVATIONS  
 1ST 2ND = FIRST AND SECOND HIGHEST VALUE FOR TIME PERIOD INDICATED  
 = ARITHMETIC MEAN (STANDARD = 0.053 PPM) METH = METHOD CODE FOR ANALYZER

**TABLE 23: 1991 INDUSTRIAL NETWORK TSP DATA SUMMARY**

SUSPENDED PARTICULATE (11101)			MASSACHUSETTS			UNITS: 001 UG/CU METER (25 C)							
P	O M					REP	--MAXIMUM 24-HR VALUES--				ARITH	GEO	GEO
C T CITY	COUNTY	ADDRESS	YR	ORG	#OBS	1ST	2ND	3RD	4TH	MEAN	MEAN	STD	
01 1 4	SWANSEA	BRISTOL CO	SHARPS LOT ROAD	91	017	59	94	82	66	53	30	26	1.6
03 1 4	LYNN	ESSEX CO	436 LYNNWAY	91	010	56	103	98	98	77	37	32	1.8
03 1 4	MARBLEHEAD	ESSEX CO	WATER TOWER, GREEN STREET	91	017	59	73	67	65	64	31	28	1.6
06 1 4	CHICOPEE	HAMPDEN CO	CORNER OF GRATTAN AND MEAD	91	031	60	135	122	115	95	50	43	1.7
13 1 4	SPRINGFIELD	HAMPDEN CO	ROSE STREET	91	031	59	111	93	82	81	47	44	1.5
09 1 4	SPRINGFIELD	HAMPDEN CO	LONGHILL STREET SUBSTATION	91	031	59	106	72	70	68	40	37	1.5
03 1 4	NORTHAMPTON	HAMPSHIRE CO	ZISKIND HALL, SMITH COLLEGE	91	031	58	90	70	62	61	32	28	1.6
01 1 4	WELLESLEY	NORFOLK CO	WELLESLEY COLLEGE	91	032	60	139	138	99	86	34	29	1.7
118 1 4	BOSTON	SUFFOLK CO	476 ATLANTIC AVENUE	91	005	56	106	100	96	94	54	51	1.5
118 2 4	BOSTON	SUFFOLK CO	476 ATLANTIC AVENUE	91	005	59	102	96	92	92	53	49	1.5
119 1 4	BOSTON	SUFFOLK CO	LONG ISLAND, BOSTON HARBOR	91	005	58	71	67	64	58	26	23	1.6
120 1 4	BOSTON	SUFFOLK CO	DEWAR STREET, DORCHESTER	91	005	57	90	89	84	84	37	34	1.5
121 2 4	BOSTON	SUFFOLK CO	340 BREMAN STREET, EAST BOS	91	005	59	90	84	82	76	41	38	1.5

CODE	SUSPENDED PARTICULATE (11101) COLLECTION METHOD	ANALYSIS METHOD
====	=====	=====
091	HI-VOL	GRAVIMETRIC

**NOTES AND SYMBOLS USED IN TABLE 23**

AIR SITE IDENTIFICATION NUMBER POC = PARAMETER OCCURENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE)  
 OR TYPE (4 = INDUSTRIAL) YR = YEAR REP ORG = REPORTING ORGANIZATION #OBS = NUMBER OF OBSERVATIONS  
 VALUES 1ST,2ND,3RD,4TH = 1ST,2ND,3RD AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR ARITH MEAN = ARITHMETIC MEAN  
 = GEOMETRIC MEAN GEO STD = GEOMETRIC STANDARD DEVIATION METH = METHOD CODE FOR SAMPLER

**TABLE 24: 1991 INDUSTRIAL NETWORK SO4 DATA SUMMARY**

SULFATE (TSP) (12403)				MASSACHUSETTS			UNITS: 001 UG/CU METER (25 C)							
SITE ID	O M		CITY	COUNTY	ADDRESS	YR	REP ORG	#OBS	MAXIMUM VALUES			ARITH		METH
	C	T							1ST	2ND	3RD	4TH	MEAN	
25-013-0006	1	4	CHICOPEE	HAMPDEN CO	CORNER OF GRATTAN	91	031	60	24.8	24.6	23.0	22.2	10.13	093
25-013-0013	1	4	SPRINGFIELD	HAMPDEN CO	ROSE STREET	91	031	60	34.0	26.2	25.0	21.8	10.34	093
25-013-1009	1	4	SPRINGFIELD	HAMPDEN CO	LONGHILL STREET SUB	91	031	59	28.1	24.0	19.4	19.0	10.01	093
25-015-0003	1	4	NORTHAMPTON	HAMPSHIRE CO	ZISKIND HALL, SMITH	91	031	58	25.0	21.3	19.9	18.7	9.17	093
25-025-0018	1	4	BOSTON	SUFFOLK CO	476 ATLANTIC AVENUE	91	005	56	25.0	20.0	18.0	16.0	9.07	092
25-025-0018	2	4	BOSTON	SUFFOLK CO	476 ATLANTIC AVENUE	91	005	59	25.0	20.0	18.0	16.0	9.05	092
25-025-0019	1	4	BOSTON	SUFFOLK CO	LONG ISLAND, BOSTON	91	005	58	23.0	20.0	17.0	15.0	8.17	092
25-025-0020	1	4	BOSTON	SUFFOLK CO	DEWAR STREET, DORCH	91	005	57	24.0	21.0	20.0	14.0	8.19	092
25-025-0021	2	4	BOSTON	SUFFOLK CO	340 BREMAN STREET,	91	005	59	25.0	18.0	17.0	15.0	8.66	092

METHODS:		SULFATE (TSP) (12403)		ANALYSIS METHOD	
	CODE	COLLECTION METHOD			
	=====	=====		=====	
	092	HI-VOL		TURBIDIMETRIC	
	093	HI-VOL		METHYLTHYMOL BLUE	

**ABBREVIATIONS AND SYMBOLS USED IN TABLE 24**

SITE ID = AIRS SITE IDENTIFICATION NUMBER    POC = PARAMETER OCCURRENCE CODE (DIFFERENTIATES BETWEEN MONITORS AT A SITE)  
 MT = MONITOR TYPE (4 = INDUSTRIAL)    YR = YEAR    REP ORG = REPORTING ORGANIZATION    # OBS = NUMBER OF OBSERVATIONS  
 MAXIMUM VALUES 1ST,2ND,3RD,4TH = 1ST,2ND,3RD AND 4TH HIGHEST 24-HOUR VALUES FOR THE YEAR    ARITH MEAN = ARITHMETIC MEAN  
 METH = METHOD CODE FOR SAMPLER INT = SAMPLING INTERVAL (24-HOURS)



1. NON-CRITERIA AIR POLLUTANTS

1.1 OVERVIEW

The Ozone and Compliance Section of the Air Quality Surveillance Branch is charged with the measurement of non-criteria air pollutants in the ambient air in the Commonwealth. The category of non-criteria air pollutants includes pollutants which have not been assigned National Ambient Air Quality Standards and for which air monitoring is not mandated according to Federal Register CFR 40 Part 58. Information and concentration data for criteria air pollutants (sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, PM-10 particulates and lead) are reported elsewhere in the bulk of this report.

Non-criteria air pollutants can be particulates or gases and include such diverse substances as inorganics (such as metals and metal salts and toxic fibers), volatile organic compounds (such as petroleum product components and chlorinated solvents), and semivolatile organic compounds (such as PCBs, dioxins and polyaromatic hydrocarbons). Many non-criteria air pollutants are considered toxic air pollutants and have DEP assigned Ambient Acceptable Limit values assigned with them. DEP's limited program to measure toxic volatile organic compounds (VOCs) in the ambient air at a number of fixed locations on a regular schedule, was suspended at the end of 1990 (it began in 1985), because of budget limitations. This program represented a pilot project, and was oriented towards methods development, rather than the goal of collecting verifiable concentration data.

Current responsibilities of the AQSB's Ozone and Compliance Section include monitoring for non-criteria air pollutants during non-continuous, short-term situations, such as emergency responses and site specific special studies. AQSB personnel respond to emergencies involving the release or potential release of high concentrations of toxic air pollutants caused by chemical fires or spills. The number of chemical emergencies that the AQSB responds to in recent years has declined. This has been the result of improved local capabilities to deal with these emergencies, as well as diminished available resources to support the AQSB's emergency response capabilities and readiness. The Air Quality Surveillance Branch responded to four emergencies in 1991.

The Ozone and Compliance Section conducted four ambient site specific source oriented special studies in 1991, involving the measurement of odor constituents, metals and volatile organic compounds. Two of these studies involved the set up and operation of multiple sampling locations, over extended timeframes.

Additionally, the AQSB periodically performs air monitoring studies in and around Chapter 21E contaminated sites when requested by DEP's Bureau of Waste Site Cleanup. Many of these studies are conducted in buildings (including residences and schools) which have been impacted from soil gas borne emissions of VOCs. During 1991, ten (10) contaminated site related studies were performed.



## 1.2 ENHANCED OZONE

During 1991, the Massachusetts DEP initiated activities to develop capabilities for future compliance with enhanced ozone monitoring provisions of the 1990 Clean Air Act (Title I, Part D, Subpart 2). The new enhanced ozone ambient monitoring program will include intensive measurement of meteorological parameters in addition to criteria and non-criteria air pollutants which contribute to the formation of high concentrations of ground level ozone. This data will be useful for verifying model predictions and evaluating the impact of ozone precursor control measures. Comprehensively equipped stations, designed to monitor meteorology and the air contaminants, will be sited (according to a prescribed progressive schedule) according to new revisions in Federal Register 40 CFR Part 58 (which specifies air monitoring procedure regulations).

The above described monitoring will be required for air quality areas designated as "serious" or higher nonattainment for the ozone NAAQS standard (0.12 ppm). Massachusetts is unique for the Northeast U.S., in that although it is a small state, it contains two serious nonattainment regions for ozone (Boston and Springfield Areas). This will require Massachusetts to design and construct an enhanced ozone monitoring network around each of the two cities, beginning with a comprehensive monitoring station immediately downwind of the center of ozone forming pollutant emissions, to be in operation by the Spring of 1993.

Depending on the objectives and requirements of the enhanced ozone monitoring network, the DEP may or may not be able to expand existing stations to meet requirements. In addition to the relevant existing pollutants which the DEP currently monitors (including ozone and nitrogen dioxide), data will be collected for other nitrogen oxides (nitric oxide and total oxides of nitrogen) as well as ozone formation contributing volatile organic compounds (VOCs). Aldehydes, a category of ozone relevant VOCs, will have to be monitored using a different methodology and equipment than other categories of organic compounds.

VOC monitoring for ozone precursors has been performed on a limited basis in the the past, with varying success. Ozone precursor VOCs can be monitored as total non-methane organic carbon (NMOC) or individual organic species (compounds). The measurement of the latter category yields more specific informaton, but presents unique challenges for the development of field monitoring devices. The organic species (up to 60 individual compounds) must be monitored using an automated gas chromatographic technique.

## 1.3 1991 ENHANCED OZONE PILOT PROGRAM

During the summer of 1991, the DEP (AQSB) conducted a pilot study to measure ozone relevant volatile organic compounds (VOCs) in the Boston Area, in preparation for future mandated monitoring efforts. The purpose of the study was to test the pertinent measurement methodologies, gather concentration data from a number of sites (6) upwind, near and downwind of Boston (southwest is the prevailing and worst case wind direction for ozone formation) and to potentially identify a location for the close downwind (to Boston area VOC sources) monitoring station to be established for 1993. A map showing the six sampling locations used during the program follows this section.

The 1991 study consisted of our participation in two complementary USEPA sponsored NMOC/Organic Species study programs. One was a regional (Northeast U.S.) study where one existing Massachusetts DEP monitoring station (Chelsea Soldier's Home) was selected to host a sampler to collect stainless steel canister samples (according to Method TO-12 of the USEPA'S "Compendium for the Determination of Toxic Organic Compounds in Ambient Air").

Samples were collected every weekday (Monday through Friday) from 6 to 9 am, from June 19 to September 16. These samples were shipped to the State of Maryland laboratory for NMOC analysis. Selected samples were analyzed for individual organic compound species. Wind speed and direction and oxides of nitrogen data from operating instruments at the Chelsea site were documented for the three hour sampling periods.

The second study component consisted of a short term NMOC (and hydrocarbon species) "saturation study" which sampled according to the previously cited method at five (5) additional locations in the Boston area during three hour time periods of likely high ground level ozone formation meteorology. Although most samples were taken during the 6 to 9 am time period to coincide with sampling activities in Chelsea, three sampling episodes were taken during the 3 to 6 pm period (on the same day as some 6 to 9 am samples). A special, second sampler was installed at the Chelsea station to accomodate afternoon samples. A total of eleven (11) sampling events (eight morning and three afternoon) were taken for this component of the program. These sampling events were scheduled for days predicted for weather with high ozone formation meteorology (hot, humid, southwest wind direction). Samples from this study were analyzed by an EPA contractor (Radian Corporation). Selected samples from this program were also analyzed for individual organic chemicals.

The two accompanying tables present summaries of data generated by the two study components. Table 25 summarizes results from the Northeast U.S. Regional Study with average and maximum total non-methane organic carbon (in parts per million carbon units), oxides of nitrogen concentration values (for the three hour sampling period) and NMOC/NOx ratio values for all participating locations. The NMOC/NOx parameter is used as an indicator to evaluate the potential to create high ozone concentrations downwind.

Table 26 summarizes results from the saturation component, including average and maximum NMOC values (and maximum dates) for the eleven episodes. NOx information was not tracked for the purposes of this study. All 6 to 9 am data from Chelsea were taken from the other study component (for the 8 morning sampling events). More detailed results are presented in a more comprehensive report pertaining to the 1991 VOC study.

#### 1.4 FUTURE WORK

The results of the above program and other information led to our selection of the Lynn Water Treatment Plant location as our first enhanced ozone monitoring station. This will be designated as a "downwind edge" (of the metropolitan ozone precursor emissions) and will



commence operation in 1993. As a lead-in to this new program, samplers for VOCs and Aldehydes will be operated at Lynn on six day schedule as part of a year-long USEPA "Toxics Initiative" study.

Another "saturation" study is planned for the summer of 1992 to help determine a good location for the Springfield Area's 1993 "downwind edge" site. The following is the schedule for implementation of the full enhanced ozone monitoring network. "Downwind" refers to the predominant wind direction, which is generally assumed to be southwest.

YEAR	BOSTON AREA	SPRINGFIELD AREA
1993	Downwind Edge Site	Downwind Edge Site
1994	Downwind Site (10 - 20 miles)	Downwind Site (10 - 20 miles)
1995	Upwind Site (10 - 30 miles)	Upwind Site (10 - 30 miles)
1996	Far Downwind (20+ miles)	
1997	Downwind of 2nd Most Prominent Direction (10 - 30 miles)	

The availability of resources and the technical feasibility of this ambitious program will determine whether it will be successfully implemented as planned.



**TABLE 25: 1991 MARYLAND NMOC STUDY - SITE COMPARISONS****NMOC CONCENTRATIONS ARE PART PER MILLION CARBON**

<b>CITIES (NEW ENGLAND)</b>	<b># OF SAMPLES</b>	<b>AVG. NMOC CONC.</b>	<b>AVG NO<sub>x</sub> (PPM)</b>	<b>MAX. NMOC</b>	<b>NMOC/NO<sub>x</sub> RATIO</b>
Chelsea (MA)	55	0.282	0.055	1.122	5.1
Hartford (CT)	66	0.332	0.055	1.002	6.5
Portland (ME)	19	0.256	0.030	0.611	10.3
Acadia Nat.Park (ME)	74	0.045	0.002	0.166	18.8
<b>CITIES (OTHER STATES)</b>	<b># OF SAMPLES</b>	<b>AVG. NMOC CONC</b>	<b>AVG. NO<sub>x</sub> (PPM)</b>	<b>MAX. NMOC</b>	<b>NMOC/NO<sub>x</sub> RATIO</b>
Arlington (VA)	74	0.256	0.054	0.754	5.0
Washington (DC)	75	0.305	0.073	0.992	4.7
Baltimore (MD) (Guildford	77	0.351	0.053	0.975	7.5
Baltimore (MD) (Old Town)	75	0.395	0.113	0.999	3.5
Philadelphia (PA)	66	0.355	0.060	0.967	6.5
Pittsburgh (PA) (Flag)	65	0.517	0.102	1.256	5.0
Pittsburgh (PA) (Lawrenceville)	95	0.440	0.058	1.505	7.3

**TABLE 26: 1991 VOC SATURATION STUDY - RESULTS SUMMARY**

**NMOC CONCENTRATIONS ARE PARTS PER MILLION CARBON**

SITES	# OF SAMPLES	AVG. NMOC CONC.	MAX. NMOC CONC.	MAX. DATE
Chelsea (Soldiers Home)	10	0.397	1.070	7/19 (AM)
Boston (Post Office Sq.)	8	0.244	0.553	7/17 (AM)
Medfield (State Hospital)	10	0.244	0.819	7/18 (AM)
Stoneham (MWRA Office)	9	0.533	1.586	7/18 (AM)
Lynn (Water Treatment)	10	0.437	1.814	8/15 (PM)
Gloucester	9	0.166	0.317	7/19 (AM)

SAMPLING DATES	
JULY 17 (AM)	AUGUST 14 (AM)
JULY 18 (AM)	AUGUST 15 (AM)
JULY 18 (AM)	AUGUST 15 (PM)
JULY 19 (PM)	AUGUST 23 (AM)
AUGUST 2 (AM)	AUGUST 26 (AM)
AUGUST 2 (PM)	



APPENDIX A: PUBLIC SITE CROSS REFERENCE

PUBLIC SITE CROSS REFERENCE: AIRS #, SAROAD #, UTM COORDINATE

CITY SITE NAME	AIRS # (SAROAD #)	UTM ZONE	UTM EAST	UTM NORTH
<u>ADAMS</u> Mt. Greylock	25-003-4002 (22-0020-002)	19	650160	4721890
<u>AGAWAM</u> Agawam	25-013-0003 (22-0030-003)	19	692120	4659040
<u>AMHERST</u> Amherst	25-015-0103 (22-0060-003)	19	703800	4696975
<u>BOSTON</u> Kenmore Square	25-025-0002 (22-0240-002)	19	327095	4690373
<u>BOSTON</u> South Bay	25-025-0012 (22-0240-012)	19	329584	4688213
<u>BOSTON</u> Sumner Tunnel	25-025-0016 (22-0240-021)	18	332910	4692500
<u>BOSTON</u> East Boston (Breman St.)	25-025-0021 (22-0240-021)	19	333008	4693531
<u>BOSTON</u> Columbus Ave.	25-025-0024 (22-0240-024)	19	329406	4690316
<u>BOSTON</u> Charlestown	25-025-0024 (22-0240-024)	19	330090	4693015
<u>BOSTON</u> Post Office Sq.	25-025-0038 (22-0240-038)	19	330840	4691500
<u>CHELSEA</u> Soldiers Home	25-025-1003 (22-0380-003)	19	332910	4696126
<u>CHICOPEE</u> Westover AFB	25-013-0003 (22-0030-003)	18	701792	4674012
<u>EASTON, NORTH</u> Post Office	25-005-1001 (22-0530-001)	19	327039	4659141
<u>FAIRHAVEN</u> Wood School	25-005-1002 (22-0570-002)	19	343300	4610800
<u>FALL RIVER</u> Fire Headquarters (Bedford St.)	25-005-3001 (22-0580-001)	19	320961	4618523
<u>FALL RIVER</u> Globe Street	25-005-1004 (22-0580-004)	19	319694	4616888



**PUBLIC SITE CROSS REFERENCE: AIRS #, SAROAD #, UTM COORDINATE**

<b>CITY SITE NAME</b>	<b>AIRS # (SAROAD #)</b>	<b>UTM ZONE</b>	<b>UTM EAST</b>	<b>UTM NORTH</b>
<u>LAWRENCE</u> Storrow Park	25-009-0005 (22-1000-005)	19	324221	4730569
<u>LOWELL</u> Old City Hall	25-017-0007 (22-1080-007)	19	310489	4723770
<u>MEDFORD</u> Fire Headquarters	25-017-3002 (22-1220-002)	19	326300	4697990
<u>NEW BEDFORD</u> YMCA	25-005-2004 (22-1500-003)	19	339500	4610110
<u>NEWBURYPORT</u> National Wildlife Headquarters	25-009-4003 (22-1520-003)	19	351293	4741568
<u>QUINCY</u> Fire Station	25-021-0007 (22-1880-007)	19	332391	4682065
<u>SCITUATE</u> Police Station	25-023-2001 (22-2020-001)	19	354000	4673000
<u>SPRINGFIELD</u> Howard School	25-013-0011 (22-2160-016)	18	699454	4663358
<u>SPRINGFIELD</u> Liberty Street	25-013-0016 (22-2160-016)	18	699140	4664480
<u>SPRINGFIELD</u> Longhill Ave.	25-013-1009 (22-2160-009)	18	700185	4661896
<u>SPRINGFIELD</u> East Columbus Ave.	25-013-2007 (22-2160-007)	18	699150	4663534
<u>SUDBURY</u> National Wildlife Refuge	25-017-1801 (22-2196-001)	19	303344	4695074
<u>TRURO</u> Cape Cod National Seashore	25-001-0002 (22-2275-001)	19	415800	4647500
<u>WALTHAM</u> U Mass Field Station	25-017-4003 (22-2340-001)	19	317750	4694520
<u>WARE</u> Quabbin Summit	25-015-4002 (22-2360-002)	18	719712	4686127
<u>WATERTOWN</u> Victory Field	25-017-1005 (22-2380-005)	19	320306	4693476
<u>WEST SPRINGFIELD</u> Fire Station	25-013-5003 (22-2475-003)	18	696403	4663920

**PUBLIC SITE CROSS REFERENCE: AIRS #, SAROAD #, UTM COORDINATE**

CITY SITE NAME	AIRS # (SAROAD #)	UTM ZONE	UTM EAST	UTM NORTH
<u>WORCESTER</u> U Mass Medical Center	25-027-0013 (22-2640-016)	19	273292	4683693
<u>WORCESTER</u> YWCA	25-027-0019 (22-2640-019)	19	269108	4682163
<u>WORCESTER</u> State DPW Yard	25-027-0019 (22-2640-019)	19	272304	4683788
<u>WORCESTER</u> Fire Station (Central St.)	25-027-0020 (22-2640-020)	19	269296	4682991

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APPENDIX B: INDUSTRIAL SITE CROSS REFERENCE

INDUSTRIAL SITE CROSS REFERENCE: AIRS #, SAROAD #, UTM COORDINATE

REPORTING ORGANIZATION CITY	AIRS # (SAROAD #)	UTM ZONE	UTM EAST	UTM NORTH
<u>ATLANTIC GELATIN</u> Stoneham	25-017-1701 (22-2180-001)	19	326462	4704385
<u>BOSTON EDISON</u> Boston (Atlantic Ave.)	25-025-0018 (22-0240-018)	19	413201	4689362
<u>BOSTON EDISON</u> Boston (Long Island)	25-025-0018 (22-0240-018)	19	337595	4686595
<u>BOSTON EDISON</u> Dorchester	25-025-0020 (22-0240-020)	19	330548	4685952
<u>BOSTON EDISON</u> East Boston (Breman St.)	25-025-0021 (22-0240-021)	19	333008	4693531
<u>EASTMAN GELATINE</u> Peabody (Meadow Pond)	25-009-1004 (22-1780-004)	19	341340	4709640
<u>EASTMAN GELATINE</u> Peabody (Fox Hill)	25-009-1005 (22-2780-005)	19	341130	4709640
<u>GENERAL ELECTRIC</u> Lynn	25-009-2003 (22-1100-003)	19	339171	4701463
<u>HAVERHILL PAPERBOARD</u> Haverhill	25-009-5004 (22-0840-002)	19	331385	4737365
<u>MATEP</u> Brookline (Fisher Hill)	25-021-0008 (22-0340-003)	19	324239	4688777
<u>MATEP</u> Brookline (Rte 9/Chestnut Hill Ave.)	25-021-0009 (22-0340-004)	19	324192	4686926
<u>MATEP</u> Boston (Children's Hospital)	25-025-0035 (22-0240-035)	19	326357	4689109
<u>MATEP</u> Boston (Deaconess Hospital)	25-025-0036 (22-0240-036)	19	326190	4689152
<u>MATEP</u> Boston (Mission Park)	25-025-0039 (22-0240-039)	19	332566	4692277
<u>NEW ENGLAND POWER CO.</u> Fall River	25-005-0010 (22-0580-010)	19	318960	4617230
<u>NEW ENGLAND POWER CO.</u> Swansea	25-005-6001 (22-2230-001)	19	317300	4624600

INDUSTRIAL SITE CROSS REFERENCE: AIRS #, SAROAD #, UTM COORDINATE

REPORTING ORGANIZATION CITY	AIRS # (SAROAD #)	UTM ZONE	UTM EAST	UTM NORTH
<u>NEW ENGLAND POWER CO.</u> Salem	25-009-2004 (22-1980-004)	19	345900	4710100
<u>NEW ENGLAND POWER CO.</u> Marblehead	25-009-3003 (22-1160-003)	19	347395	4707922
<u>NORTHEAST UTILITIES</u> Holyoke	25-013-1005 (22-0860-005)	18	697554	4683012
<u>NORTHEAST UTILITIES</u> Springfield (Longhill Ave.)	25-013-1009 (22-2160-009)	18	700185	4661896
<u>NORTHEAST UTILITIES</u> Springfield (Carew St.)	25-013-1010 (22-2160-010)	18	699855	4666415
<u>NORTHEAST UTILITIES</u> West Springfield	25-013-5002 (22-2475-002)	18	698639	4662867
<u>NORTHEAST UTILITIES</u> Hadley (Summit House)	25-015-1002 (22-0789-002)	18	699160	4685971
<u>NORTHEAST UTILITIES</u> Hadley (Hopkins Academy)	25-015-2001 (22-0789-001)	18	693398	4690214
<u>NORTHEAST UTILITIES</u> South Hadley	25-015-3002 (22-2126-002)	18	699012	4679687
<u>PIONEER VALLEY TSP GROUP</u> Chicopee	25-013-0006 (22-1400-006)	18	697069	4672615
<u>PIONEER VALLEY TSP GROUP</u> Springfield (Rose/Page St.)	25-013-0013 (22-2160-013)	18	702346	4668346
<u>PIONEER VALLEY TSP GROUP</u> Springfield (Longhill Ave.)	25-013-1009 (22-2160-009)	18	700185	4661896
<u>PIONEER VALLEY TSP GROUP</u> Northampton	25-015-0003 (22-1600-003)	18	694700	4687800
<u>WELLESLEY COLLEGE</u> Wellesley	25-021-5001 (22-2420-001)	19	310150	4684780



**APPENDIX C: MAPS OF PUBLIC STATIONS BY PARAMETER**







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